The science news monthly

# SCIENCE DIGEST

OCTOBER 1965 35 CENTS ICD

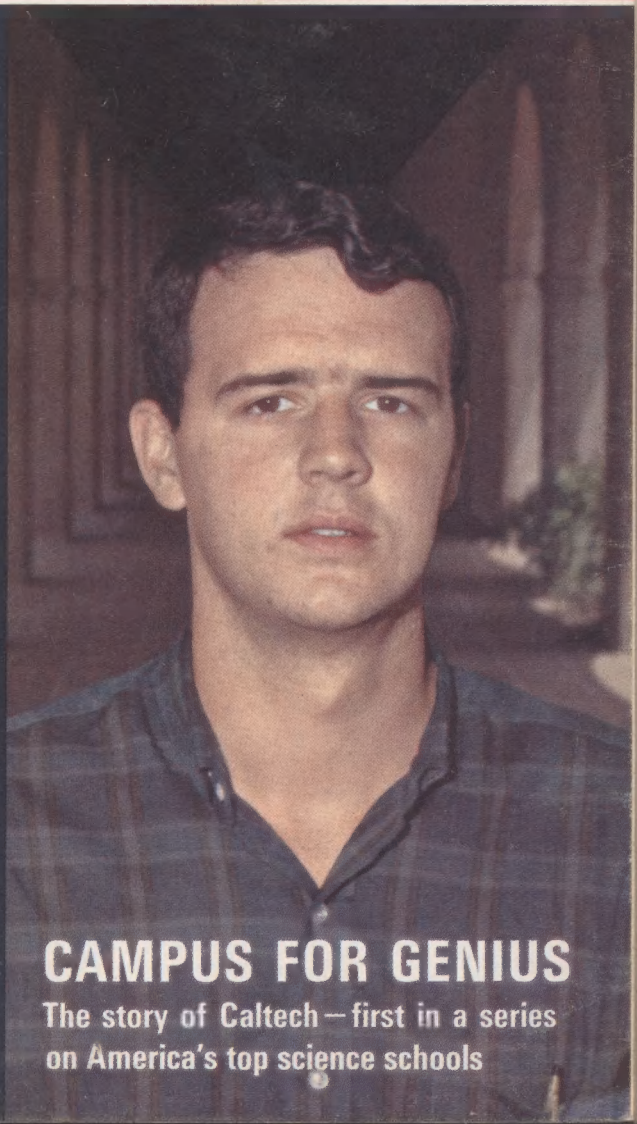
## Hypnosis
. . . what it can and can't cure

Why nobody wants women in science

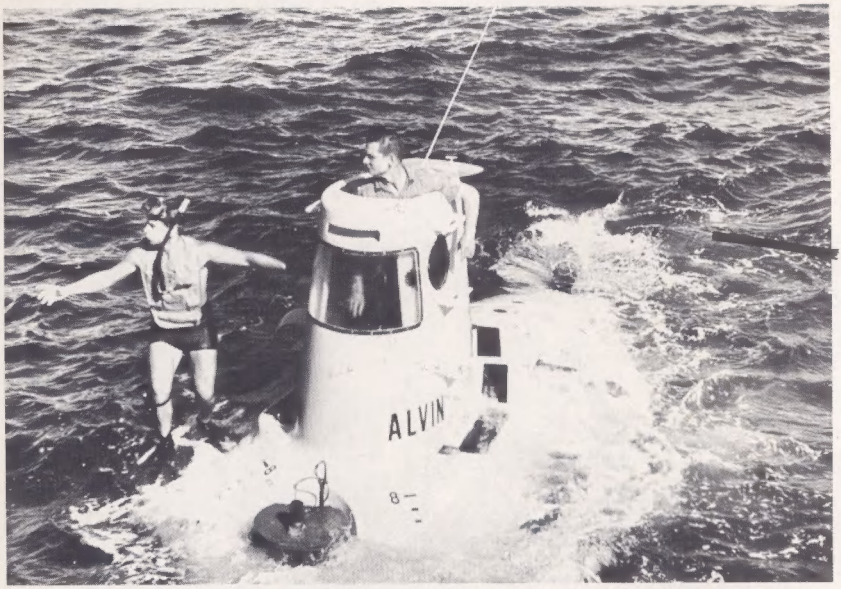
Hopeful, new look at the common cold

New way to relieve pain within minutes

Photo story: those moon-bound chimps



## CAMPUS FOR GENIUS
The story of Caltech—first in a series on America's top science schools

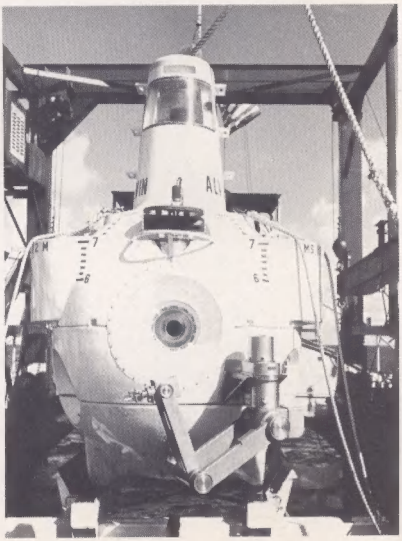



# Alvin dives a mile

Above: Alvin being readied for its deep diving test in the Bahamas. Standing in the craft's sail is Marvin McCamis, one of the two crewmen who piloted Alvin on the dive. Below: On land, Alvin shows its mechanical arm for taking ocean floor samples.

"UNEVENTFUL" was how William O. Rainne, Jr., pilot of the research vehicle Alvin, described a record-making six-hour, 6,000-foot (one nautical mile) dive into the Tongue of the Ocean, a submarine canyon in the Bahamas. The dull news was good news to the men at Woods Hole Oceanographic Institution, for it meant their new deep-diving submarine has passed its final test and could begin an intended program of oceanographic research.

Bathyscaphs have gone deeper than Alvin, but unlike the immobile bathyscaph, Alvin can alter its rate of descent, move forward or backward and hover at any depth.



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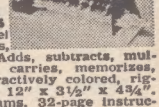

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YOU MAY be interested to know some of the problems of editing a science magazine.

One of them occurs to us as we complete the monthly task of "making up" this issue. Make-up is the term used to describe the computer-defying job of taking all the stories we have and putting them together in the appointed categories and having them all come out to the precise number of pages the printer is set up to handle.

## THIS MONTH

That's obviously a problem in itself. But one that pains us even more is the problem of deciding *what to leave out of the issue.*

We always have much more than we can possibly use. And that's a problem not many magazine editors face. For science today makes news every day, and every day we must recast our plans for the issue we're preparing. Stories of all varieties spring from the science news. Some are important, others are of special interest, others are just wonderfully revealing or appealing or amazing. But all contribute to the ever-changing picture of this world of ours and of the universe in which it circles, a picture that science helps make brighter and more hopeful each passing month.

So some things we just have to leave out, painful as it is to do so. We hope you like what we leave in —and come back for more.

—THE EDITORS

# SCIENCE DIGEST

The science news monthly

Eric Young (right) is that rare species of scientist-to-be who was accepted by Caltech. He's from Elko, Nevada, and is starting his junior year. His "option" (major) is electrical engineering. For the story of his unique school, see page 48.

**OCTOBER • 1965** VOL. 58, NO. 4

## SCIENCE THIS MONTH



## SCIENCE PANORAMA



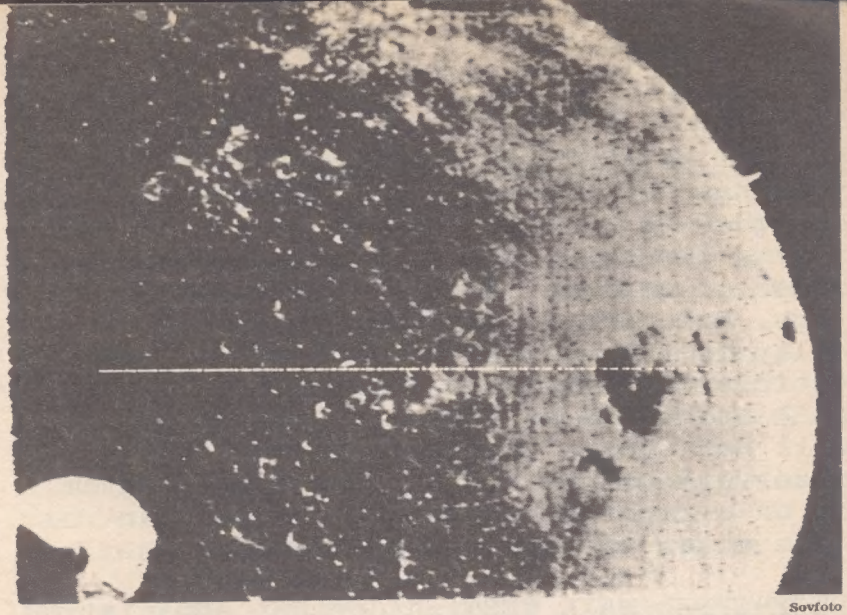
## SCIENCE MISCELLANY

# THE LATE SCIENCE NEWS

SIZZLING VENUS. Lingering hopes that Venus might support life received a blow when two radio astronomers - one American, one Russian - published the results of a survey of the planet. Their findings indicate that the surface of Venus has temperatures ranging from 675° F. at the equator to 300°F. at the poles. The observations confirm very high temperature readings picked up by the Mariner 2 Venus probe. Some scientists had disputed the Mariner figures. Balloon-borne telescope observations made by Johns Hopkins University scientists suggested water vapor and even ice existed in Venus' atmosphere.

INSECTICIDES IN AIR. British scientists have found traces of various insecticides including DDT and dieldrin in rainwater, implying that the atmosphere is now contaminated by them. Air-borne insecticides may account for the recent discovery of traces of DDT in the fat and liver of Antarctic seals and penguins. One British scientific committee described the situation as "somewhat terrifying."

U.S. EXPLORES SOVIET SEA. An American scientific expedition is exploring the little known Kara Sea near Soviet Siberia. It is the first Western scientific expedition to enter the area since the 1920's. The Kara Sea is near Novaya Zemlya, one of Russia's atomic test sites and scene of the world's only 100-megaton explosion.



Sovfoto

BACK OF THE MOON. The Soviet Union released some of the photos of the far side of the moon taken in July by the space probe Zond 3. One of the photographs (above) shows one fifth of the far side not previously photographed by the Soviets with their 1959 Lunik probe. These new, clearer photos indicate that the far side of the moon is quite different from the side visible from earth. Most obviously, no large dark areas called "marias" are visible on the far side. It seems to consist mainly of so-called highland areas, full of craters and other irregularities. Already the scientific debate on the meaning of the photographs and the reasons for the differences between the two sides of the moon has begun. Ewen A. Whittaker of the U.of Arizona speculated that the gravitational attraction of the earth accounted for the marias on the near side. Dr. Harold Urey, on the other hand, maintained that the marias were caused by collisions with huge meteors and that the differences between the sides were chance.

TROUBLE WITH APOLLO 'CRAWLER.' Tests of the huge "crawler-transporter" that is designed to move the Saturn 5 moon rocket to its launch pad have been suspended because of serious trouble with roller bearings. No one will estimate how long the delay on the $6-million, 5.5-million-pound vehicle will be, or how much it will cost. NASA spokesmen say the crawler's problems will not delay the Apollo launch, but observers point out that the moon program is on a tight schedule and the crawler is a vital part of the preparations.

HIGH-SPEED RAIL TEST. A Johnson Administration plan for a three-year program to develop and test a high-speed railroad system is meeting approval in Congress. The test will cost an estimated $90 million over a three-year period. If approved, the first step in the test will be to build about 20 miles of high-speed track near Trenton, N.J.

ASTRONAUT RESIGNS. Dr. Duane E. Graveline, one of the six scientist-astronauts chosen for the Apollo program, has resigned as an astronaut for personal reasons.

ASTHMA AND CIVIL RIGHTS. The incidence of asthma has been rising rapidly among Negroes and Puerto Ricans in New York City. For instance, there has been a jump from 3 to 30 percent of emergency room admissions for asthma at Harlem Hospital between 1952 and 1962. Asthma has always been considered, at least in part, a psychosomatic disease and many specialists believe the rise may be due to tensions generated in connection with the civil rights movement.

BIG UFO FLAP. The summer of 1965 was the best season in several years for sighting UFO's or flying saucers. Authorities in several southwestern states were deluged with thousands of reports. There was also an unconfirmed story that some of the objects were tracked by Air Force radar. Air Force spokesmen in Washington denied that any of the objects had been tracked and stated that a study indicated that all the observations were astronomical in nature. They may have been the planet Jupiter or one of several bright stars.

QUICK 'MONO' TEST. A simple, inexpensive blood test for infectious mononucleosis, requiring only two minutes, has been developed by Wampole Labs of Stamford, Conn. It has been tested by several state health departments and medical and hospital labs and its accuracy is rated 99 percent.

HOPE FOR 'BLEEDERS.' A research team at Stanford University has found a simple and cheap way of concentrating the protein substance lacking in the blood of hemophilia victims. The protein can control bleeding.

QUOTE OF THE MONTH: "Many of us feel instinctive revulsion at the hazards of meddling with the finely balanced and far-reaching systems that make an individual what he is. Yet I believe it will surely be done or attempted. The pathway will be built from a combination of altruism, private profit and ignorance." -DR. ROLLIN D. HOTCHKISS of the Rockefeller Institute speaking at a symposium on "The Control of Human Heredity and Evolution."

—1—
# THE ASTRONOMY STORY

The largest crater, 75 mi. across, and the highest elevation, 13,000 ft., are both here.

## Obituary of a planet

MARS is dead. Geologically, but not biologically.

Even before the later, more revealing photos came in from Mariner 4, speculation had begun. Four different detectors on Mariner 4 had found no Martian magnetic field. "If there are any Martian men, they do not use compass needles," joked William Pickering, director of the Jet Propulsion Laboratory. No magnetic field probably meant no liquid iron core like the earth's. Circulation in the core, it is believed, is the dynamo that creates the field. No core, in turn, meant that Mars had never melted as the earth had and separated into layers, with heavy iron sinking to the center and the light continental rocks floating to the top. Pickering reminded newsmen that the red color of Mars could be from limonite, an oxide of iron, if iron were distributed uniformly throughout the planet instead of concentrated in the middle.

If Mars had never melted, the line of speculation continued, there might not be enough heat today to fire volcanoes or push up mountains. And without a light crust, there would be no breaking apart into continental islands with ocean basins between.

When the analysis committee saw the clear photos that came in later, they were "shocked really beyond belief," and the speculation was confirmed. The committee saw "a densely cratered surface, closely comparable to bright upland areas of the moon." Perhaps only Fred Whipple, head of the Smithsonian Astrophysical Observatory, had foreseen that. Last year, he told a Mars conference that the planet might be extensively scarred with meteorite impacts because it was on the inner edge of the asteroid belt.

Seventy craters from 2.5 to 75 miles in diameter were sighted on the photos, which would mean 10,000 on all of Mars. Earth would

Whitening may be frost. White spots may be peaks. It is late on a winter afternoon.

look like the moon, too, if it weren't geologically jumping. Volcanoes bury craters; mountains push up through them; earthquakes shake them to pieces; rain, wind, waves and plants tear them down. Today only 116 meteorite craters remain to be seen in the whole world. The oldest on Mars may have survived two to five billion years, worn down only by sand storms.

A geologically dead Mars is less likely a biologically alive one. The earth's magnetic field traps deadly radiation from the sun and space in the Van Allen belts. Under our magnetic shield, we also have a thick, protective atmosphere. Mars turned out to have one only one to two per cent of ours. As a result, radiation at the surface of Mars is about 50 times greater than here, although "not a frightening value," to James Van Allen.

The lack of signs of dried up oceans was more serious. Many theories about life on Mars assume that up to the point when life was born in the oceans, Mars and Earth developed alike. As Mars lost its oceans and most of its atmosphere, life simply adapted to the new conditions.

The analysis committee cautiously stated that "the Mariner photos neither demonstrate nor preclude the possible existence of life on Mars."

The public interpretation, however, was too gloomy for Nobel prize winner Joshua Lederberg, professor of genetics at the Stanford U. School of Medicine. "I doubt that Mars has ever had extensive oceans," he wrote in a rebuttal to *The New York Times*. "More likely almost all of its water has been frozen for most of its history." The photos do show "bright patches on some craters suggesting frost." Whether there is underground ice or only frost, "we have the likelihood of scattered oases with local conditions far more congenial to life than the average for the planet."

Sanford Siegel, who pits earth life against Martian atmospheres at the Union Carbide Research Institute, toned down his earlier predictions (see *Science Digest*, July '65). He now talks of micro-like forms reached in a possible brief, early atmospheric and oceanic stage. Thus he thinks it is still "reasonable" to expect life on Mars. In fact, his first reaction to the photos was, "What a fascinating and weird place for life to evolve."

*—Bruce H. Frisch*

—2—
# THE ASTRONOMY STORY

## Scientists argue:

### It's lava foam.

Gerard Kuiper is sure lava flows foamed in the moon's vacuum. "If you walked on the moon it would be like crunchy snow."

### It's dust.

Thomas Gold says he is daring, but not daring enough to land on the moon. The thick dust would cling like Spanish moss.

### It's firm.

Eugene Shoemaker wouldn't be afraid to step out of a moonship. Debris layer is thin; most got knocked clear off.

### It's sinking.

Harold Urey is "scared" that a top 50- to 60-foot layer of finely divided material is sinking into underground crevasses.

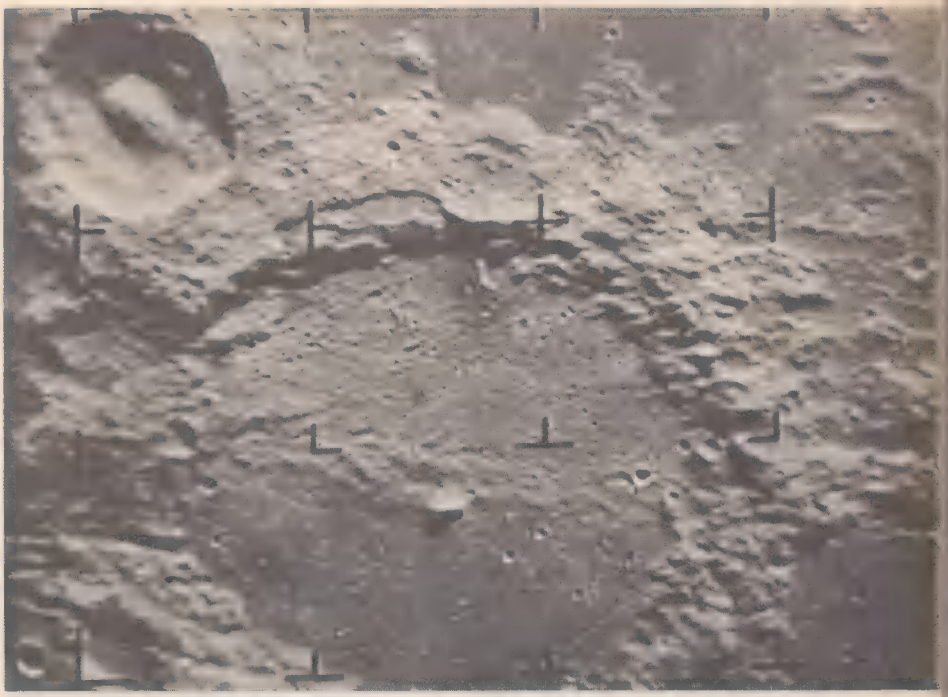
**by Bruce H. Frisch**

AFTER three perfect Ranger shots that sent back 17,259 pictures of the moon, scientists still cannot agree on what the surface is like.

Will astronauts step out onto a firm rock foam or sink over their heads in soft dust?

A rosy glow surrounded the first interpretations given to newsmen by two members of the analysis panel a few hours after the first photographs, taken by Ranger 7, reached Earth. Dr. Gerard B. Kuiper and Dr. Eugene Shoemaker had been chiefly responsible for advising Apollo planners on what the moon is made of. They were happy to tell newsmen that their original judgment was confirmed by

# What IS the moon made of?



If other areas should prove too forbidding, we could land on the top of a crater rim. Ranger 9 found that of crater Alphonsus surprisingly free of the pits that dot the floor.

the photos. There were no "totally unforeseen problems," said Kuiper. Shoemaker said he wouldn't hesitate to step out of a landing craft onto the moon.

President Johnson was delighted. As a senator and as vice-president, he had shaped the space program in large part. In the rush to reach the moon by 1970, landing vehicles were designed before we knew what they had to land on. At a White House briefing the day after the press conference, space officials assured the President that 99 percent of the dark, dry Sea of Clouds, where Ranger 7 had landed, was suitable for a landing. The photos indicated that there could be no deep layer of dust predicted by some scientists, the officials said. Exactly what President Johnson

wanted to hear them say.

But a third member of the analysis panel had not been at the press conference. In the weeks following, Dr. Harold Urey, Nobel prize winner in chemistry, and professor at large at the U. of California, let it be known that he disagreed with Kuiper and Shoemaker. "You cannot tell what the surface material is from pictures," he said. Although he had not gone to the press conference, NASA had known his opinion, he said.

One month after the Ranger 7 shot, Kuiper and Shoemaker were confronted at an international astronomy conference by cosmologist Dr. Thomas Gold of Cornell U. He saw no reason to revise his theory that the lunar seas were deep in dust, he said. The battle lines were drawn. Two Ranger shots later, the four men have not budged an inch.

How can they be so far apart when they are all looking at the same pictures? Gold put his finger on the reason: "The Ranger pictures are like a mirror. Each experimenter holds them up and sees his own theories reflected in them." There are perhaps four principal theories of how the moon's surface was formed. These four men have authored three.

Kuiper, director of the Lunar and Planetary Laboratory at the U. of Arizona, believes that in the first 100 million years of the moon's estimated 4.5 billion years' existence, there were enough radioactive elements in the moon to melt it completely. A thin crust formed which was bombarded with meteorites. The largest broke through the crust, and lava gushed up into the immense craters to form the dark, smooth lowlands called maria or seas.

## Volcanic domes

Thus, when Kuiper looked at the Ranger photos, it was no surprise that he saw "plenty of evidence of volcanism"—central peaks in some craters, and some peaks with their own craters; low domes, which he compared to shield volcanoes in Hawaii, and some domes with collapsed roofs, which he compared with calderas or collapsed volcanic cones found on earth.

"The maria are lava flows," he went on. In the Sea of Clouds he identified seven lava flows 60 to 600 feet thick. When the lava broke through the surface into a vacuum, the top 30 feet frothed. A rain of small particles including cosmic dust "sand-blasted" the surface, but did not accumulate on top. Thus, Kuiper said, "The moon has no cover of cosmic dust even one millimeter thick." Nor is there any "noticeable cover of debris from lunar impacts or explosion," except from those close by.

Sand-blasting, he went on, eroded the lava face into the smooth contours seen in the photos, leaving a weakened "sharp, brittle" layer one or two inches thick. "I am willing to bet that if you walked on the moon it would be like crunchy snow," he told Congress.

One of the most startling new sights revealed by the Ranger 8 photos of the Sea of Tranquillity were 100- to 1000-foot-diameter depressions or dimples without the raised rims of craters. These may be where an underlying layer of froth collapsed, Kuiper suggests, or have other volcanic origins. Liquid lava may have drained away, or trapped gas escaped or cooling rock contracted.

As far as Apollo is concerned, Kuiper's two most important conclusions are that "there is not a ghost of a chance of a thick dust layer," and that his lava froth may support a ton per square foot.

Almost as different as possible from Kuiper's interpretation is that of Thomas Gold. Born in Austria, educated at Cambridge, now at Cornell, he is best known for his part in developing the steady-state theory of the universe. Gold believed that the large craters making up the seas of the moon were originally dry and had filled with dust nicked from the moon by constant impacts. In places, the dust may reach depths of up to 2.5 miles, he has estimated. To get dust many miles from the highlands down gentle slopes to the lowlands, he calls on a peculiar mechanism. As a result of ultraviolet and other solar radiation from which the atmosphere protects Earth, the surface of the moon becomes electrically charged. The repulsion floats dust to the seas.

The dust is soft on top and firm

Dimples, apparently sunken areas without rims, may account for 90 percent of the craters on Alphonsus' floor. And 3,300-foot-high peak has no visible volcano-like crater.

# Everyone wanted to believe the best. Mooncraft design remains unchanged.

below where vacuum welding joins the particles into a "fairy-castle" structure.

With this mental picture already formed, Gold looked at the same Ranger photos Kuiper had and found, "There is nothing that could be regarded as lava flow." In fact, he noted, close-up details were largely soft and rounded; there were no rock outcrops, and craters revealed "no hint of any transition to a different material below." He stuck to his theory of deep dust in the seas.

If the dust is electrically charged, he said, an astronaut venturing out of his mooncraft will be coated with long, beard-like strands of dust like Spanish moss. Attempts to brush them off will only make matters worse. When he returns to his ship, the dust will ruin electronic gear.

What is worse, Gold warns that the soft dust may endanger the landing itself. "If I were at the controls of an Apollo vehicle tomorrow and I were hovering over the lunar surface, I would not be willing to set it down—and I am a daring man in other things—for fear that it would sink too much."

Urey's theories fit somewhere between Kuiper's and Gold's. Like Kuiper, he believes there is lava in the seas. Like Gold, he thinks there is dust there.

Urey differs from Kuiper in believing that the moon has never melted. Therefore, lava could not have sprung from below. Instead, portions of the large, relatively slow-moving solar-orbiting bodies that gouged out the seas partially melted on impact. At the same time a cloud of dust and gases rose from the collision. The gases fell as rain, washing the dust off the mountains to the seas.

"The moon's surface was fashioned mostly by collision," he wrote before the Ranger shots, but "some small formations were caused by volcanic processes."

### "Fairy castle" topping

Urey's views after he saw the Ranger photos followed suit. He noted some mild volcanic activity, and spoke of the seas as lava flows. Yet he also pointed out that the low thermal conductivity of the outer surface as measured from Earth indicated the possibility that Gold's soft, spongy "fairy-castle" topping extends "to some depth."

Although he also used Kuiper's term, "crunchy snow," on occasion, the appearance of dimple craters in Ranger 8 and 9 photos pushed him toward a vision of a deep covering of finely divided material over the seas. The dimple craters are 50 to 60 feet deep, Urey estimated, and may mark the depth of the material. The dimples may be caused by the finely divided material "slump-

ing" into voids or underground crevasses.

In April, an international group of astronomers met in Greenbelt, Maryland, to discuss the lunar surface. After Gold recited the tale of himself at the controls of a hovering spacecraft, Urey agreed: "The Ranger's 9 pictures scared me more than anything. There is all sorts of evidence that some of these craters are sinking."

"Not everybody is scared," shot back Shoemaker. "Landing is just not a problem. They are talking about dangers in the mission that just aren't significant in relation to other engineering dangers involved in making the flight—rendezvous and any number of things."

Shoemaker, a geologist with the U. S. Geological Survey, is different from the others. He doesn't have a famous theory to protect. To his eyes, as Ranger 7 plunged closer to the moon, "instead of growing rougher," as he had expected, "the surface began to smooth out . . . Probably the 10- and 6- and 2-foot craters I had expected had in fact been made, and in about the numbers I had anticipated. But they had been erased by the enormous rain of minute missiles, which I had not anticipated." The missiles, he figures, are micro-meteorites and particles from comet tails. Most of them probably weigh about a millionth of a millionth of a gram. They are fast-moving, so knock pieces *off* the moon. The USAF Cambridge Research Laboratories, Bedford, Mass., calculates the moon may lose weight at the rate of up to 600 tons a day.

Fifty feet may have been chipped off the face of the moon, Shoemaker estimates, removing old craters up to 500 feet across. Only small craters that are recent remain. Little debris stays on the moon. "I'd now figure it to average less than a foot thick, to be fairly firm, and to present no problem for spacecraft or astronaut."

## Ice flows

Other scientists besides the big four have added to the overflowing stock of interpretations. Dr. Donald A. MacRae of the U. of Toronto says the seas are ice flows. The moon is coalesced of fragments resembling comet nuclei, which are mostly ice. Domes on the moon may be pingos, an Eskimo word for conical hills lifted by swelling ice. When the ice melts, the center collapses. A fluffy residue left behind by the melting ice becomes compact 15 to 30 feet down.

Dr. John O'Keefe of NASA's Goddard Spaceflight Center thinks the seas are ash flow.

None of these explanations satisfy Dr. Thomas Gehrels, an associate of Kuiper at the U. of Arizona. He describes the moon as smooth as a ping-pong ball, but with a thin cloud of dust suspended a fraction of an inch above it by an electric charge.

As if the picture weren't confused enough, NASA sent collections of the Ranger photos to astronomers

around the world to get more reactions.

The most important point for the Apollo landing, of course, is how much weight the lunar surface can bear. Although always ready to offer an opinion, each of the big four has constantly hedged it with statements like Shoemaker's that we can't really tell "without putting something down on the lunar surface and patting it."

Around early October, or at least by the end of the year, NASA intends to send the first Surveyor to do just that. However, the first four are intended mainly to send back engineering data on how they are working. If they reach the moon, it will be an extra bit of luck.

Ranger photos have not changed Surveyor design at all. It is based on a model of the moon surface chosen in 1963 before the first Ranger. The model "is the best fit to a range of theories," says Ben Milwitzky, Surveyor project manager. The range includes hard rock at one end and, at the other end, material that has no strength at the surface, can support ten pounds per square inch one foot down, 20 pounds per square inch two feet down and so forth. The range doesn't cover Gold's dust theory. With the softest assumed material Surveyor will sink a half inch.

The three spidery legs, with what look like saucers on the ends, will be rigged to measure the forces on them and how quickly Surveyor stops. A television camera will swing down to see what the feet have done to the surface.

For getting a deeper understanding of the moon, Urey has said, a few automatons won't do. Only men standing on the moon can grasp the significance of its many and complex phenomena. In June, six scientists were chosen to make field trips there. But judging from Ranger experience, six different scientists could mean six different stories.

### *1,200 lbs. of heart for research*

THREE frozen whale hearts, weighing 1,200 pounds, have arrived in Chicago from Oslo, Norway. They were donated to an Abbott Laboratories research project by a Norwegian whaling fleet operator, Jorgen Jahre.

Researchers needed about 160 pounds from three species to study the cell structure of a protein, cytochrome *c*. It appears that cytochrome *c* is a central link in a system that produces body energy through rapid metabolism of food. Abbott is trying to discover the mechanism of the system. Cytochromes *c* of man, monkey, horse, turtle, kangaroo, sheep, chicken, duck, rattlesnake, tuna and screw worm fly have been analyzed already. The whales were captured in the Antarctic Ocean by a factory ship. The Jahres are noted for contributions to medical research. Jahre reportedly felt the donation was minor: "They only asked for three —it was really nothing."

# PERSONALITY OF THE MONTH

## A scientist takes over the Air Force

THE man who will take over the job of Air Force Secretary this month is unique in two ways. At 38, he is the youngest man ever to hold the office. Second, and more significant, he has a Ph.D. in physics, whereas most service secretaries are businessmen or lawyers.

But Dr. Harold Brown (above) is no raw university recruit to government service. He has had a long association with the Defense Department. Before being appointed Air Force Secretary by President Johnson he had served as Director of Defense Research and Engineering since 1961. In this position Dr. Brown was chief adviser to Secretary of Defense Robert S. McNamara on many technical subjects.

According to the journal *Science*, "The chief significance of the appointment appears to be the placing of a technically trained man who is closely identified with Secretary McNamara's policies in the top operational civilian job in the Air Force.

"Brown's office figured in the decision to clip the wings of the B-70 program, cancel development of the Skybolt missile, and scrap the Dyna-Soar project air-space plane and other acts which brought no joy to the Air Force."

He was born in New York City, Sept. 19, 1927, and was educated in the city's public schools and at Columbia University, where he received his Ph.D. in 1949.

After spending a year in post-doctoral research at Columbia, he joined the University of California Radiation Laboratory at Berkeley.

In 1952, when the Livermore site of the Radiation Laboratory was established, he became a staff member there. By 1960, Dr. Brown was appointed director of the Livermore Lab.

Since 1956, he has served as a high-level technical advisor for the Department of Defense in a variety of capacities. He was appointed to the President's Science Advisory Committee in 1961.

The theme of his public career has been: "Science before politics."

INSIDE PSYCHIATRY TODAY

# Retarded children: out of the attic

by Flora Rheta Schreiber and Melvin Herman

WHEN President John F. Kennedy signed the Child Health and Mental Retardation Amendment on October 24, 1963, he did so with these words: "We can say with some assurance that, although children may be the victims of fate, they will not be the victims of neglect."

Until the last decade neglect had been severe. We know of a mentally retarded child in Knoxville, Tenn., who grew to manhood in an attic. His parents did not want to show him to the neighbors. Other retarded children, erroneously labelled "insane," have been relegated to the back wards of state mental hospitals for their lifetimes.

Today, however, there is almost universal recognition that the retarded person deserves a good life. Every state now makes some provision for the education of retarded children (although the number of special classes is still inadequate). Important educational techniques, such as programmed learning which involves the use of visual aids, teaching machines and the like, have been specially adapted for the training of the retarded. The University of Chicago has developed a "task force" of faculty members, students and neighborhood residents who go into the culturally deprived area surrounding the University, where the number of mentally retarded is above the national average, and initiate enrichment programs at the nursery school and kindergarten level. At the Devereux Schools in Pennsylvania, Texas and California, programmed learning through teaching machines has been part of the curriculum for several years.

There is also considerable research. In one project, 50,000 pregnant women in 15 medical centers

President John F. Kennedy supported care for the mentally retarded and signed the Child Health and Mental Retardation bill.
National Assn. for Retarded Children

are being studied. In addition, there are studies of genetics, of techniques for immunization against damage-causing agents, and even of parent-deprived newborn monkeys. Since the founding of the Joseph P. Kennedy, Jr. Foundation in 1946, 14 institutions for the care and treatment of mentally retarded children have been established. Eunice Kennedy Shriver, the executive vice-president of the Kennedy Foundation, conducts her own annual camp for the mentally retarded, as does the Devereux Foundation. Other camps, such as Camp Kenton in Middleburg, Va., are springing up.

Congressional legislation, legislation within the states, a Presidential Commission, the support of junior chambers of commerce, all contribute to the awakening. For the first time the mentally retarded are finding their way into federal government employment.

The emphasis, as expressed by Dr. Gerald R. Clark, medical director of the Elwyn School in Media, Pa., is to help the retarded to lead constructive lives within the framework of society. "The old philosophy," Dr. Clark told us, "that the mentally retarded had to be protected from society and society from them no longer holds."

Society today assumes the responsibility of helping the six million Americans or about 3 percent of the population that, by having IQ's below 70, are classified as retarded. The IQ is not used as a diagnosis but has proven to be a useful measurement in discussing retardation. The 126,000 mentally retarded babies born in the United States each year now have better prospects of living reasonably good lives. In the last five or six years there have been many more classes for the educable (IQ's 50 to 75), and the trainable retarded (IQ's 25 to 50). Through these classes, the educable have become occupationally useful in the community.

## Degree of retardation

In planning for the retarded it is essential to differentiate between those who are retarded through disease and inherited disorders and those who are affected through poor living conditions and parental deprivation. It is important to distinguish, too, among the various degrees of retardation, whether it is severe, moderate or mild.

The success of any plan for the retarded depends upon ending the myths of the issue. One such myth is that mental retardation is an emotional disturbance which clearly it is not. The truth is that, despite intellectual deficiency, some of the retarded, if properly stimulated, can grow into adults who can work, marry, and develop good family and social relationships on their own level.

Physicians and social agencies must help the retarded child's family to meet the inevitable emotional crises engendered by the child's condition. Happily, the family physician has developed new know-how. For the first time in history, ac-

# Rebuffs, school and poor health are crises for the retarded child.

cording to the American Medical Association, the family physician has the necessary resources to meet the problem. His alertness may permit identification of the retarded child years before it would otherwise be made. This makes possible the beginning of therapy that may modify or reverse the course of the disorder. For, in an increasing number of instances, detection and diagnosis of an underlying biological abnormality can lead to the prevention of brain disease and consequent retardation. Such therapy is particularly helpful in cases of socio-cultural retardation which springs from environmental rather than genetic or chemical causes. Enrichment of environment begun early enough may save some children from a lifetime handicap.

Parents require the help of professionals in weathering the crises they are bound to face. After learning of her child's retardation, one mother attempted suicide. When her attempt failed she realized, through the help of wise counselors, that her child needed her. She not only kept her child at home where she gave him devoted care but she also lead in forming an association of parents of retarded children. Moreover, by successful lobbying in her state, Tennessee, for enlightened legislation for the retarded, she was effective in helping other children like her own.

Later crises include the decision to send the child to school, meeting the rebuffs the child sustains from neighborhood children as well as his own brothers and sisters. Ordinary family crises, such as acute illness, the father's change of job, moving, the birth of other children, assume larger proportions because of the presence of the retarded child.

## Special problems

The retarded child presents special problems not directly related to his mental insufficiency. Even though, as we have stated, retardation does not initially grow out of an emotional disturbance, emotional problems do frequently emerge later because of the pressures the child encounters. The result of these pressures may be temper tantrums, rebelliousness, the acting-out of anti-social behavior and feelings of defeat and inferiority that lead him to withdraw more or less completely. These handicaps are multiplied by distorted patterns of maternal care. The mother may over-protect or reject the child.

The health of the retarded is likely to be poorer than that of the

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Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

total population. Three out of every four retarded persons have significant medical problems. They also suffer from physical handicaps in speech, gait, vision (even though some have remarkably acute vision and hearing).

As the child grows older, problems of adolescence, his choice of work, his separation from home and his marriage loom larger than in ordinary circumstances.

Adolescence, a period of trial for the normal, is an even greater trial for the retarded. The tensions may become so great that anti-social behavior occurs at this period. There is no truth, however, in the widespread myth that the retarded become criminals. The IQ's of criminals have been shown to be the same as that of the general population.

### Lack of judgment

Sexual problems at adolescence are common among the mildly retarded but not among the moderately and severely defective who have very limited sexual drives. The mildly retarded have normal sexual drives with which they may be unable to cope because of their lack of judgment and control.

There are, however, great individual differences. While some of the retarded require lifelong protective care, others achieve a striking degree of independence and hold jobs. Some actually slip into the general population without needing special medical attention.

Many of the differences in adaptation stem from the causes and degree of retardation. Causes are neither simple or easily isolated. Even though over 200 causes of retardation have been identified, physicians can actually assign the cause in only about one-fourth of the cases. In most instances, doctors can define retardation only in terms of functional characteristics, the lack of intellectual ability and of social adaptation.

## Some can be "cured"

When the retardation is the result of a poor environment and failure of the mother and father to stimulate the child, the child can be "cured" in the sense that his IQ can be raised. Dr. James McHunt estimates that experiences in the first two or three years of life can raise or lower the IQ of some children by as much as 30 points. For children whose defect is due to inherited or congenital causes, the handicap must remain continuous from birth or early childhood until death. But even these children can live happy lives.

The differences in adaptation are the result of the care the child receives. Good care—the fulfillment of a child's potentiality, limited though it is—depends upon taking advantage of the surprising individual strengths that some retarded children display, notably: remarkably acute vision, hearing and tactile sensation, as well as relatively good memories which make it possible for them to learn with repetition.

We must caution, however, that too many children have been falsely classified as mentally retarded. A child may appear retarded because he is suffering from defective hearing or vision, cerebral palsy, a language or emotional disorder, delayed speech or a chronic illness.

## Nonspeaking children

The notion that the nonspeaking child is mentally deficient is widespread. The mentally deficient have long been classified in terms of the language they use. Those who use simple sentences have been called simpletons; those who use simple words, fools; and those who use only simple sounds, idiots.

Tragically, some nonspeaking children somehow have been committed to institutions for the mentally deficient. Fortunately, however, reliable institutions for the mentally deficient test children before accepting them.

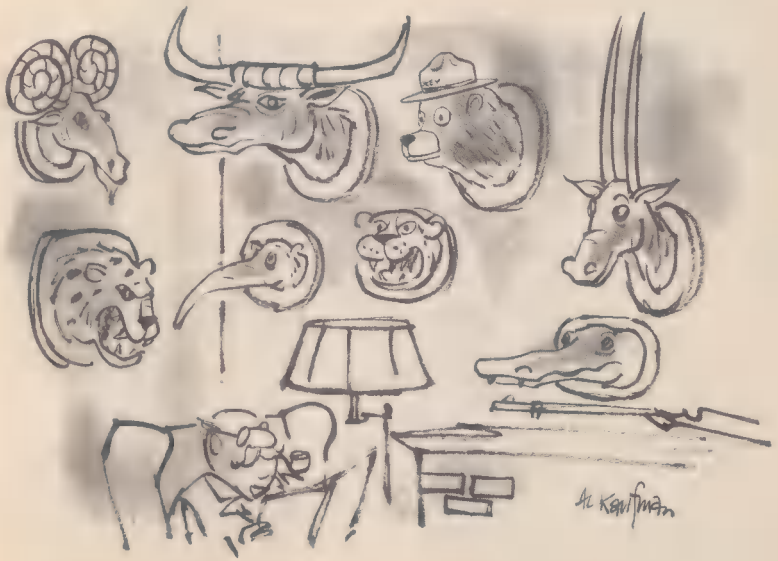
Much is known about mental retardation, but much remains to be discovered. As research progresses and filters into community action, it is important to recognize that prevention is the greatest "cure" for retardation. Children who have become retarded because of mentally ill, depressed or otherwise rejecting mothers, can join the ranks of the normal. The psychologically disturbed mother may be so disorganized as to give her child only ambiguous stimulation. Her verbal signals may contradict the physical

messages she conveys. For example, she may handle the child roughly while declaring how much she loves him. The ambiguity of these messages may render the child unable to apprehend, evaluate or respond appropriately to his social environment. Children who suffer these varying deprivations may appear apathetic, unresponsive and functionally retarded. Removal of the causes can restore the youngsters to normal lives.

There is further prevention in the care of pregnant women. More than 200 diseases and infections attacking pregnant women carry a partial responsibility for mental retardation. Some of them can be prevented—German measles during pregnancy, RH blood incompatibility, and blood poisoning.

### The cost

The mentally retarded are being restored to humanity. To accelerate the process, it is important to note that it costs the government an average of $50,000 to care for each retarded person placed in a government supported institution. The parents must discover what public and private day schools are available in their areas. When shortages exist, local schools should be encouraged to notify community and civic leaders.

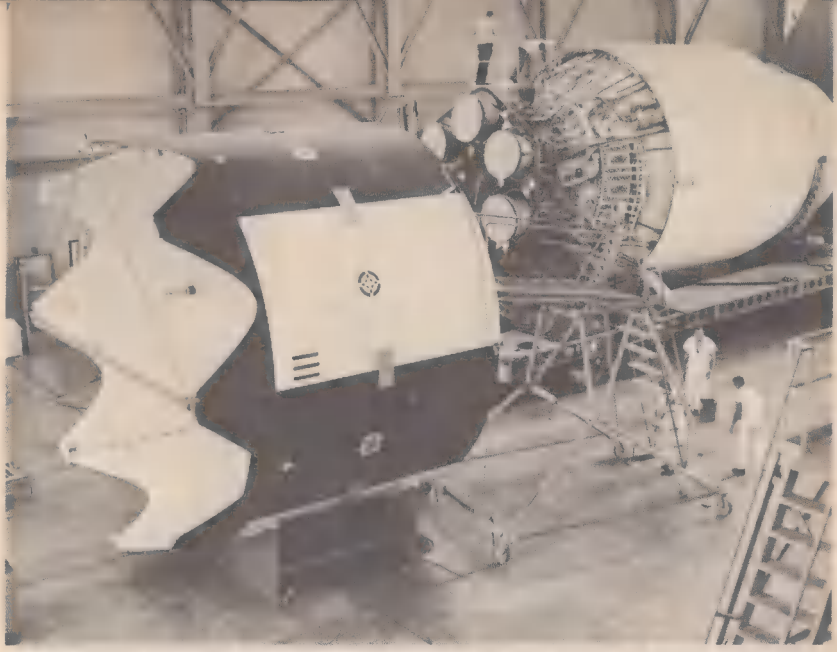


# THE SPACE PICTURE

## Space science attacks the water shortage

NASA long has been interested in turning waste water into drinkable water. A successful method could be used in a closed ecological system envisioned for space capsules embarked on long journeys. But NASA research may have a more immediate earthbound application.

Above: Technician studies the interaction of heat and light on algae as part of research on the tiny water plant that helps remove impurities in water. Below: Algae growing in a test pond at Lancaster, Calif., is skimmed off and turned into poultry feed. This byproduct may make the reclamation system economically competitive.



Technicians check out the Saturn booster designed to hoist the Pegasus C satellite into orbit. A feature of the Pegasus C shot is to test the long-range possibility of returning meteoroid punctured metal samples from the satellite's huge "wings" to Earth.

Astronauts Gordon Cooper and Charles Conrad, Jr., crew for the Gemini 5 mission, demonstrate the operation of a full scale mock-up of the Rendezvous Evaluation Pod planned for use on their mission to develop techniques for later rendezvous missions.

# THE PHYSIOLOGY STORY

## The hormone that produces quints

First, signs of sterility, then hope raised by a new hormone, then a high chance of twins, triplets, quadruplets or quintuplets. This is the sequence of events for approximately half of the women treated with an experimental anti-sterility hormone, Pergonal.

A Swedish woman and a New Zealander both gave birth to quintuplets in July after receiving the hormone. And a flurry of triplets and quadruplets last fall were attributed to the drug.

Naturally-occurring multiple births are rare enough to be calculated in powers of 80. This means that twins are born about every 80 births, triplets every 6,400 births, quadruplets every 512,000 and quintuplets every 40,960,000 births. These figures are the square, cube and fourth power of 80.

The mortality risk is much higher with multiple births than with a single birth. For example, four of the Swedish quints died the day of birth and the remaining child was in serious condition for two weeks. They were 11 weeks premature. However, in New Zealand, Mrs. W. W. Lawson was delivered of four girls and a boy, seven weeks premature, "in perfect health" according to hospital doctors in Auckland. All of her quints weighed between four pounds, three ounces and three pounds, three ounces.

Experience with the drug in the United States, Europe and England indicates that multiple births occur in about half of the women treated. However, only a small percentage of infertile women may be treated with the hormone. It is used only where infertility results from an inability to produce mature eggs, a disorder responsible for five to ten percent of infertile women.

The drug Pergonal consists primarily of a follicle-stimulating hormone (FHS). The hormone is manufactured by the pituitary gland and affects the ovaries. It stimulates the development of mature ova, or eggs. In fertility treatments, the hormone is injected daily for 10 days or so until the physician estimates that a "critical period" in the ova maturation has been reached. Then another hormone, human chorionic gonadotrophin (HCG) is injected. It causes the follicles of the ovary to rupture and release the egg, which can then be fertilized. Another part of the gonadotrophin prepares the womb for implantation of the fertilized egg.

The desired dosage will cause the release of one mature egg and a single birth will follow. Apparent-

U.P.I.

Quintuplets of Mrs. W. W. Lawson of New Zealand were vigorous and large at birth. The fertility hormone she took is available in the U.S. on a research basis only.

ly, too much FSH can cause several eggs to mature simultaneously. Each egg, in that case, is ready to be fertilized and grow into a baby. Dosage is not only critical but varies with the patient. However, after the births of the quints, two British doctors, Arthur Crooke and William Butts, reported they had perfected a "right dose" technique. Twenty of their 22 patients had or will have babies. There have been two sets of twins, but Dr. Crooke said they came early in the research.

More than 100 women in this country are being tested with the preparation. A fertility clinic spokesman of Columbia-Presbyterian Medical Center says that 15 of 20 women treated with Pergonal became pregnant one or more times. Among the offspring of the 12 women who gave birth to live babies, there were four sets of twins and one set of quadruplets.

Dr. John MacLeod, an anatomy professor of Cornell University Medical College, says that a potential danger of the hormone is the cysts that sometimes occur on the ovaries after treatment.

Pergonal is distributed by Cutter Laboratories in California and is extracted in Italy from the urine of menopausal women. A kindred hormone, with the same clinical results, comes from human pituitary glands, taken at autopsy. The latter is used in New Zealand.


# The brawl for science dollars

by Bruce H. Frisch

UNCLE Sam hands out $15 billion a year for science.

Who gets it, why and for what now threatens to degenerate into a nasty brawl for "loot."

The fight has already been under way for two years.

It started in 1963, when Congress cried STOP! to the zooming rise in federal support for scientific research and development funds it had been okaying on faith until that year.

At first, the issues were more or less polite:

Is basic research such as chasing elementary particles a frivolous amusement of scientists?

Isn't it more worthwhile to spend money on "more useful" applications such as new kinds of atomic reactors?

Who should plan national science policy—the Administration, Congress or scientists themselves?

The fight began to get mean over the building of a $280 million

atom-smasher. It aroused the same lusts as a dam or a highway.

Today, federally-supported R & D is in danger of becoming another pork barrel.

The rise in Federal spending for research and development over the years has been swift. In 1938, the Department of Agriculture accounted for one-third of government R & D spending. It took World War II to show what a government-science team could do. Afterwards, scientists were anxious for the partnership to continue.

The "startling technological achievements of World War II" seemed to scientists "the rapid consumption of a stockpile of basic knowledge," recalls Don K. Price, dean of the Harvard Graduate School of Public Administration. We "could make up for the loss only by a large-scale program for the support of basic science."

The Korean War and Sputnik spurred Congress to go along, so that by the period 1957 to 1963 the federal R & D budget was rising 20 percent a year.

Congress awoke when it was confronted with a $15 billion outlay in 1963. Its first reaction was to call a halt. Its second was to loose a barrage of probes.

"Tell us about the duplication, waste and extravagance," began Representative Clarence J. Brown, (D., Ohio), at the first hearing of the Select Committee on Government Research (Elliott Committee).

By the end of the year, scientists at a meeting of the American Association for the Advancement of Science were groaning, according to *The New York Times,* "Science in America is in trouble—in trouble with the Federal Government, with a sizable segment of the general public and, to a large extent, with itself." Several scientists said, "The party's over."

## Opening maneuver

It was right at this time that the bid for expensive new atom-smashers had begun. The opening maneuver, as is often the case in new projects, was the recommendation of a panel convened by the President's Science Advisory Committee and the Atomic Energy Commission (AEC).

It called for the construction of three atom-smashers: a 12.5 billion electron-volt (bev), $148 million, high-intensity proton accelerator; a 200-bev, $240 million (later raised to $280 million), proton accelerator, and, for the 1970's, a 600- to 1,000-bev, $1 billion, proton accelerator.

The AEC vetoed the 12.5-bev accelerator within months. Midwestern Congressmen who had hoped for it were dismayed. They had learned that the R & D budget not only was big, it was also distributed unevenly geographically, and the Midwest wasn't getting its "share." A 1964 study showed California in first place with 38.4 percent of R & D money, New York second with 9.2 percent and

# Twenty states are dangling a free land lure to catch an atom-smasher.

Massachusetts third with 4.6 percent. The 12.5-bev accelerator was to have been in Madison, Wisconsin; the chief candidates for the 200-bev accelerator were the Lawrence Radiation Laboratory in California and the Brookhaven National Laboratory in New York. If they didn't get an accelerator, Midwestern Congressmen implied, they wouldn't vote for one on the East and West Coasts later.

They were particularly anxious to get a research project because it is a fairly consistent rule that industry follows research. The San Francisco Bay area and Route 128 around Boston have been booming while the Midwest suffers a "brain drain." Although the states of the Big Ten universities graduate 40 percent of the nation's scientists and engineers with advanced degrees, they lose a high proportion to the Coasts.

Other links between a concentration of research and prosperity are now turning up in hearings of the Subcommittee on Employment and Manpower of the Committee on Labor and Public Welfare, held singlehandedly by Senator Gaylord Nelson, (D., Wis.). Some of the considerations mentioned so far include local entrepreneurial spirit, permissiveness by universities on outside employment by faculties, and bankers who will take risks.

From their first disappointment, Midwesterners learned a lot about lobbying. Indiana has now offered free a 3,000-acre site valued at $10 million in order to catch an atom-smasher, what Governor Roger Branigan has called the "scientific prize of the century." Thirty-nine other states are in the race, and 20 contenders are dangling the lure of free land.

## Nix the politics

Standing up to these pressures, AEC chairman Glenn Seaborg told Senator Nelson that only in the case of a close tie between sites would the economic impact of the accelerator be considered. That's not exactly the kind of thing politicians like to hear. The National Academy of Sciences is now helping get the AEC off the hook with a Committee on Site Selection designed to take the politics out of the choice.

It is probably too late.

"Whatever the outcome, politics is destined be a crucial factor," says Philip Abelson, editor of *Science*, journal of the American Association for the Advancement of Science. It's no news that government science officials and scientists oppose adding geography to scientific competence as a standard for granting research funds. But they do have an answer. They prefer to separate the two by developing second-

rate universities into "new centers of excellence" in areas that most need industry. A modest $25 million was voted for the purpose last year.

### Political slices

This tactic also may be in vain. On all R & D, *Science* reports, Congressmen have settled down to "concentrating on getting fair slices for their districts."

Aside from where our money goes is the question of what is goes for. Are we dividing our R & D dollar among the sciences wisely?

The Joint Committee on Atomic Energy was particularly concerned that the giant accelerators for basic research were squeezing out its pet applications, a nuclear rocket and a nuclear power plant for satellites.

"There is no end to scientific ambitions to explore," cried the chairman, Senator Chet Holifield, (D., Calif.) "but there is an end to the public purse."

Two conflicting desires have been pulling at the committee. In the past, writes nuclear scientist Ralph Lapp in his book, *The New Priesthood*, the committee voted "more of everything since the committee's influence grew with the AEC's affluence." At the same time, he also notes, "Congress has wearied of the excessive fiscal demands of high energy physics and shows a preference for projects which have more meaning for voters."

Congress has always been partial to hardware and suspicious of basic research projects with funny-sounding names. What scientists have had to say about basic research has hardly been comforting to practical minds. "All pure research is just a big marvelous gamble," said G. C. Wick of Brookhaven.

But Congress wants a sure thing. Some scientists have tried to give it one, claiming that all basic research is eventually useful. Yet, when 30 physicists collaborated on the writing of a book, *Nature of Matter: Purposes of High Energy Physics*, to justify super accelerators, none, rightly, would guarantee what application of the research would result.

### Detailed information

What, then, would justify the building of super accelerators?

Well, the atom-smashers would be able to see smaller details of the atom and artificially create larger atomic particles.

The 200-bev accelerator, for instance, will produce higher speed protons. As a result of their speed, the protons will possess greater energy; greater energy is necessary to see finer details of the structure of matter.

The energy is also used to create elementary particles. To create the heavier particles now postulated will take more energy. In the end, theoretical physicists hope to make sense of the messy array of particles they discovered with the present accelerators. Perhaps they will determine the simple outlines of

# Where should the money be spent? Ask 100 experts, get 100 answers.

how matter is constructed on its smallest scale.

The simplest justification of the expense of the accelerators came from Hans Bethe of Cornell U., who said, "I believe that particle physics deserves the greatest support among all the branches of our science, because it gives the most fundamental insights."

So far, basic research can probably claim a draw. The rounds of hearings in Congress, *Science* concludes, "have reinforced the sense of mystery that many laymen feel about science. . . . The general attitude seems to be that we don't understand it too well, or at all, but it's good for the country."

As a precaution against future raids on basic research money, efforts are being made to enlarge the National Science Foundation and put in its sympathetic hands most of the job of supporting basic research.

Any big raids would have to be made on the applied research and development portion of the R & D budget. Basic research accounts for only 3 to 11 percent. Spending on weapons and space by the Department of Defense and the National Aeronautics and Space Administration accounts for 75 per cent.

In the 1963 Economic Report to Congress, President Kennedy pointed up the dilemma. "We have paid a price for our defense and space efforts," he said, "by sharply limiting the scarce scientific and engineering resources available to the civilian sectors of the American economy."

Harold Orlans, member of the senior staff of the Brookings Institution, wants to divert some money from defense and space R & D to government-sponsored research to boost the efficiency of civilian industries like housing, transportation, textiles and coal. But he recalls that when the Department of Commerce proposed a $7 million program of assistance to civilian technology, Congress turned it down.

## Change in direction

The Elliott Committee, in its January report, was more sympathetic to a switch in direction. One of its two main findings was that we should put some of the money going into defense, space and nuclear research, into studying social and economic problems.

The committee also found that NASA, the AEC and the Department of Defense set up huge new programs which absorb large numbers of scientists and engineers without considering whether they could be better used elsewhere (civilian industry, for instance).

Such confusion leads the average observer to ask: Don't we have a

master plan for science? No we haven't. But Congress is beginning to demand one. As a result, the big accelerators have hit a year-long snag. Before putting up the money for the 200-bev machine or any others, the Joint Committee on Atomic Energy wanted them fitted into a national policy for high energy physics of the kind worked out for space.

## Overall policy

Impossible, said scientists and the AEC. No one could predict in what direction a new discovery might send researchers. The committee held firm, insisting it wouldn't raise the AEC budget without a plan. "The ambition of the scientists cannot be a guiding principle," said Chairman Holifield.

How to resolve the impasse? While an overall national science policy has long been lacking, there are signs now it may be on the way.

Science policy was one of the duties given to the National Science Foundation on its formation, but the NSF was afraid to touch such a hot issue. Finally the job was switched to the White House Office of Science and Technology. But nuclear scientist Lapp doubts whether this combination of high-level part-time science advisers and low-level full-time staff can piece together a policy. An alternative, a Cabinet-rank Department of Science and Technology, pushed by Vice-President Humphrey when he was a senator, has gotten the cold shoulder from the Executive and the scientists.

Then Congress took an interest, and the House Space Subcommittee on Research under Representative Emilio O. Daddario, (D., Conn.) said it was time for Congress to give "effective direction" to the nation's scientific efforts.

This shocked the National Academy of Sciences, which had previously kept its distance from Congress, into risking political contamination. To get a science policy by scientists on the record before the politicians, NAS agreed to have a 15-man committee answer two questions for Rep. Daddario: 1. How much federal support of basic research do we need? 2. Where should it go?

## Needed: a blueprint

NAS had a lot of courage in tackling what many scientists thought were almost unanswerable questions, but its courage failed at the crucial time. Instead of making a joint report, each of the 15 scientists issued his own. The result was 310 pages of discussion and reasons why they couldn't answer the questions. It wasn't a simple blueprint men could die for.

The same sort of fragmentation has hampered Congressional progress. Many committees and subcommittees have power over a tiny portion of R & D and won't give it up. When the Elliott Committee recommended pooling Congressional power in a Joint Committee on Re-

search Policy, the idea fell flat.

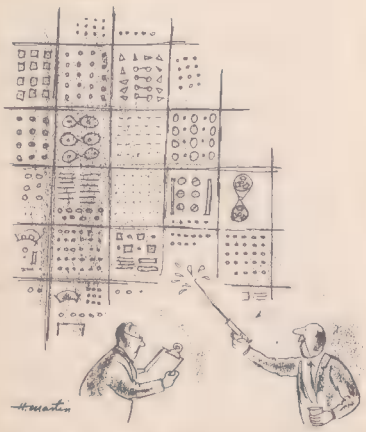
Nevertheless, Congressional pressure is having an effect. With this year's budget request, for instance, the President sent to the Joint Committee on Atomic Energy what the AEC called "a policy for national action" in high energy physics. President Johnson, however, called it a "guideline," leaving the committee unsure whether or not it had the "national policy" it was looking for.

## Decisions

Greater Congressional interest has also pushed science decisions out in the open.

Both the old way and the new way of reaching decisions are illustrated by the accelerator story. The old way was the way in which the presidents of 26 universities, with the midwifery of the AEC, NAS and NSF, incorporated early this year, then offered themselves as manager of the 200-bev accelerator and its $50-million-a-year operating budget "It was organized without any public notice or discussion," said *Science*. "Traditionally, that's the way of doing business at the summit of the scientific community."

The new way was the way physicists broke their gentlemanly silence to join public debate with their book, *Nature of Matter: Purposes of High Energy Physics*.



"Hey look, Charlie! Water on the brain!"

## Future routes

Enough other information has come out in the rounds of hearings to start observers wondering if science and the Executive branch have been doing a decent job informing the public.

After all the debate, Congress now seems ready to smile on the 200-bev accelerator. Construction is expected to begin in 1966 at a site picked by the end of the year.

So all in all, science has got through the past two years in good shape. Basic research, the most vulnerable part of R & D, is holding its own. Meanwhile, just by asking questions, Congress has been able to reshape how we spend our science dollar.

In the future, the way it is spent will be more public and more planned. It will also be more political—and polemic.

# THE PROGRESS OF MEDICINE

## Is it really emphysema?

by Arthur J. Snider

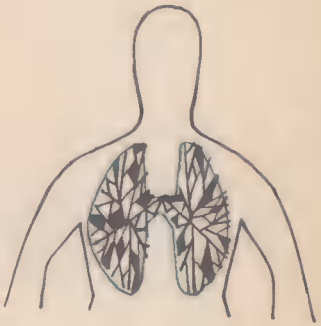
THE country is on an emphysema kick. Doctors have become so emphysema-conscious, many people who are breathless are being misdiagnosed as having the lung disease.

A chest specialist, Dr. Theodore H. Noehren of Buffalo, N.Y., says, "These mislabelled persons are suffering only from hyperventilation, a relatively harmless discomfort."

Hyperventilation is a condition in which there is abnormally prolonged, rapid and deep breathing. This "fighting for breath" is commonly seen in emotional adolescents, neurotic females, tense soldiers and many others who are reacting to stress. It has been estimated that as many as 10 percent of patients visiting doctors' offices have a hyperventilation syndrome in one form or another.

Emphysema, on the other hand, is a distinct lung disease in which there is abnormal distention of the air sacs and obstruction in the bronchial tubules so that all waste air cannot be expired. It leaves the patient with a marked shortness of breath.

Since its discovery in 1949, emphysema has risen rapidly in the roster of diseases. Estimates are that ten million people in the United States alone suffer from it. It is second only to heart disease in Social Security compensation benefits.



Dr. Noehren says the increased concern has stimulated so much publicity in the medical and lay press that a peculiar backlash in the form of over-concern and over-diagnosis has resulted.

"The two entities require entirely different treatment but are easily distinguished from each other by simple laboratory tests," he said.

### Beware of too much aspirin

Aspirin in large doses can make one drunk. It can cause confusion, bizarre behavior, stupor, movement disorders and swollen eyes. Like

alcoholics, the aspirin-gulper often is unable to give a clear history of what he has ingested until after the toxic effect has worn off.

While there have been reports of an overdose of aspirin as a means of suicide, little attention has been given to patients who through accident or ignorance consume excessive amounts of the drug in treatment.

Dr. Kendall B. Corbin of the Mayo Clinic, Rochester, reports on five persons who took excessive doses over an extended period of time in misguided attempts at therapy.

One was a 59-year-old man with nerve pain. He was hospitalized because of confusion and agitation which deepened into coma. After his intoxication had subsided, he estimated taking, in increasing doses, about 700 five-grain tablets in 15 days.

A 51-year-old man with persistent pain in the lower chest took about 1,000 aspirin tablets a month before admission. Examination showed a cancer of the esophagus. He died in six months.

A 67-year-old woman with long-standing rheumatoid arthritis was admitted because of mental confusion and paranoid delusions. She said she was taking 16 aspirins a day.

Another 67-year-old woman with a tumor was admitted after her children found her sitting dishevelled in a rocking chair, hallucinating that bugs were on the wall. She admitted taking aspirin from time to time but forgot how much aspirin she had consumed.

A fifth patient was a 31-year-old housewife with unsteady gait, incoherent speech and breath odor. She admitted taking 20 to 25 aspirins daily for several months and, in the last week before admission, increasing that to 50.

The Mayo physician said aspirins have a large margin of safety but there are individual tolerances to the drug.

## Drug for the comatose

A drug that will revive an unconscious person long enough for him to answer questions, an invaluable diagnostic aid, is under study by Col. R. J. Hoagland, commanding officer of the Army Medical Research Center, Fort Knox, Ky.

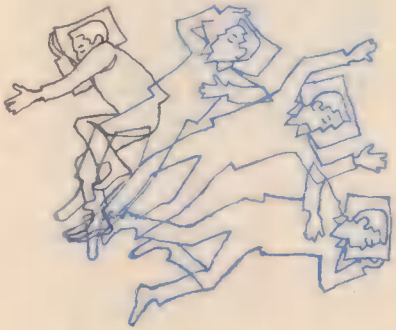
A soldier, brought to a hospital in a deep coma thought to be caused by inhaling poison gas, regained consciousness long enough to say he had not been near gas. He complained of eye trouble. This permitted doctors to diagnose his case as a brain tumor.

The drug, methylphenidate, seems to induce talkativeness after inoculation in small doses.

Dr. Hoagland cites the possibilities of its use in the case of a store owner who is found beaten and robbed and in a coma. It would be helpful to police in the apprehension of his assailant if he could be revived for a moment for a description.

### *Restless sleep*

Sleep like a log? No one really does. The average person moves around from 35 to 50 times a night, says Dr. Joost A. M. Meerlo in *Medical Times* magazine.



In addition, about 4 million Americans are occasional or habitual sleepwakers. Most, however, do not wander outside their own bedrooms. Rare is the individual, says Dr. Meerlo, who clambers over the rooftops until some instinctive alarm bell brings him back to bed.

### The perils of home life

One out of three fatalities to American children results from an accident and 60 percent of these accidents occur in the home, according to Dr. Jay M. Arena, director of the poison control center, Duke University School of Medicine.

"Accidents do not just happen." Dr. Arena says. "They are caused by a sequence of events. Parents, especially mothers, must be made aware of the factors that produce them and learn to prevent them. Passive protection is not enough. It is necessary for the child to understand the risks he runs."

He lists the following 10 safety suggestions in *The West Virginia Medical Journal*: (1) Baby-proof your home by removing booby traps. (2) Ask what you would need to do if you were going to leave your child alone for just one hour. (3) Assume leadership by specifying safety rules. (4) Ration your commands but enforce them. (5) Punish the child when he violates obedience rules and reward him for obeying. (6) Don't set goals too high to reach. (7) Forbid dangerous games. (8) Have your child taught to swim at an early age. (9) Be consistent. (10) Make cars safe inside and drive safely, obeying highway rules.

### *Virus dryer*

A ladies' hair dryer has been found to be an effective treatment for a virus infection of the eye that often causes severe discomfort and even blindness.

The virus, known as Herpes simplex keratitis, is apparently sensitive to the heat of the dryer.

Dry air, heated to 140° F, is directed into the infected eye for about five minutes with the hand-held dryer.

Herpes simplex is the virus responsible for the common cold sore

on the lip. When the same virus invades the eye, infection tends to recur. Each episode causes more permanent scarring of the cornea.

Until recent years, the infection was treated by cauterizing the cornea area involved. Then an antiviral drug, IDU, was discovered to have a favorable effect in many cases of infection. Dr. Everett R. Viers of the Scott and White Clinic, Temple, Tex., believes the hair dryer is the most effective treatment of all.

## Another baby boom?

Seven million American girls are approaching the peak marriage years of 18 to 21. As they start having babies, will they follow the higher fertility pattern of the 1950's or the lower fertility of the early 1960's? The future size of the U.S. population will be determined by the direction taken. The Population Reference Bureau reports that a 40 percent increase occurs between now and 1970 in the number of women in the prime child-bearing ages of 20 to 29.

If they choose the "two-to-four-child" family—the fashion set in the 1950's—then the nation is in for a baby boom of unprecedented magnitude. Such a high fertility rate during the late 1960's and the decade of the 1970's could result in a population of nearly 400 million by 2005.

If they follow a trend toward fewer babies—the "one-to-three-child" families—the prospect of 300 million Americans in 2005 will be the more likely.

There has been a downward shift in the fertility pattern since 1957.

Robert C. Cook, president of the Population Reference Bureau, said the motivation for it is probably the recognition that rearing and educating children is an expensive undertaking.

At the present death rate in the U.S., an average of 2.2 children per family is necessary to maintain a stationary population.

## *Birthmark treatment*

About one out of 20 people is born with a port-wine stain on the head and neck. The condition usually fails to respond to the conventional methods of treating discolorations, such as radiation, carbon dioxide snow therapy and surgery.

Now Dr. Herbert Conway of the New York Hospital-Cornell Medical Center finds the appearance of these people can be improved through tattooing. In the *New York State Journal of Medicine*, he reports on 735 patients with port

wine stain, known medically as capillary hemangioma. Relief from deformity was achieved in about 8 out of 10 and the remaining patients improved enough to reduce their makeup problem.

"Since port wine stains do not grow after birth, and since there is no authentic case report of the malignant degeneration of such lesions, their single objectionable feature is color," Dr. Conway reports. "Thus, it seems logical to treat an abnormal color phenomenon by a color camouflage process."

The pigment is tattooed deep in the dermis. Adults are treated with regional nerve blocks, small children under general anesthesia. An average of five treatments is needed to hide the birthmark.

## Social weight control

Social climbing, like mountain climbing, can contribute to reduction of the waistline.

A new study shows obesity may depend in large part on one's socioeconomic status and ethnic background. It was found to be six times as common among women of lower economic status when compared with upper-level groups.

Also, the longer a woman's family has been in this country, the less likely she is to be obese.

"It is now apparent that obesity can no longer be viewed simply as an abnormal characteristic of the individual," said Dr. Phillip B. Goldblatt of Michael Reese Hospital, Chicago, co-author of the study with Dr. Albert J. Stunkard of the University of Pennsylvania.

The study was conducted in midtown Manhattan and described in the *Journal of the American Medical Assn.*

Ethnically, nine percent of females of British descent, for example, were obese as contrasted to 27 percent of Italian extraction. This reflects the custom of the Italian mothers to feed their children well as protection against disease, the authors said.

Another example concerned the Czechs, among whom there is a great deal of visiting on Sundays and serving of large quantities of food. To refuse a second or third helping is considered impolite.

"It seems quite possible that the lack of success in the control and treatment of obesity stems from the fact that until now physicians have thought of obesity as always being abnormal," the authors said.

"This is certainly not true for persons in the lower socioeconomic population. Obesity may always be unhealthy, but it is not always abnormal."

They believe the time has come to direct weight control programs toward specific groups where obesity is most common rather than in a non-specific way to rich and poor alike.

"Recognition of the significance of social factors in obesity," according to the authors, "may lay the foundation for our first effective public health program for the control of obesity."

# INVENTIONS PATENTS PROCESSES

## How to make a giant tire

AIR-FILLED, rubber tires 50 feet in diameter—or larger—can be built through a new construction concept introduced by The Goodyear Tire & Rubber Co. Conventional construction limits total diameter to 10 feet.

The tire can be made in strips of carcass and tread which are then woven together. Final assembly can take place on the job, thereby easing problems of handling and shipping. In the first application of the concept, engineers at Goodyear made four model tires, five and one-half feet tall. Each one consists of 112 straps of molded rubber reinforced with parallel nylon cords. The straps are wide in the middle and taper towards both ends. They follow a gentle S-curve which engineers describe as a "modified geodesic path." Diamond-shaped pieces of tread rubber are molded onto the straps to increase wear and to give the assembled tire a diamond tread pattern for traction.

To assemble the tire, straps are woven together and the ends bolted to the wheel rim. Tubes, flaps and tread liners are placed inside to maintain air pressure and provide puncture protection.

The tires could carry giant land cruisers with heavy loads and roll more easily over unimproved terrain. For example, oil exploration in northern Canada, miles from civilization, could be carried on effectively from a cruiser big enough to carry all personnel, supplies, instruments, living quarters and drilling equipment needed for a month.

Engineers estimate that a single 50-foot woven tire would support a load of 165,000 pounds. The weight would be spread over such a large ground area—115 square feet—that the force on the ground would be only 10 pounds per square inch, less than carried by an auto tire. The low ground pressure would enable a giant land cruiser to traverse sand, mud, snow or swampy terrain without bogging down.

### *Goodbye to the auto graveyard*

Junk yards filled with wrecked cars, useless refrigerators and worn out appliances may be a blight of the past if a new approach to reclaiming scrap metal lives up to initial promises.

"Controlled high-temperature incineration," an experiment by the Bureau of Mines of the Department of the Interior indicates, may make it possible to burn off thin coatings and attachments of copper which often "poison" steel scrap and render it useless as raw material for making new steel.

At present, the cost of separating and sorting out metals in junked cars and major home appliances is

higher than that of primary sources.

The Bureau ran experiments on copper-clad steel strips in a laboratory-scale furnace. Temperature, reaction time and speed of air flow over metal were controlled. Layers of copper oxidized entirely to form a loose, scaly coating that fell off easily, leaving the steel free of surface contamination.

## Lazy way down

A new type of "slow descent" parachute for mesopheric research has been designed and tested by the G. T. Schjeldahl Company of Northfield, Minn.

The parachute design enables it to open in space before it encounters the thin air of high altitude stratosphere. The parachute is hemispherical in shape and the canopy is separated from the main skirt, but attached to it at 18-degree intervals. A tubular inflatable ring is attached to the canopy to help open it at altitudes of 40 miles.

Attention to a sculptured look and functional design has resulted in this lightweight dial-in-handset telephone. In production now, the Bell System Trimline contains a dial, receiver and transmitter in the headset. This feature makes it possible to install the phone in limited or awkward locations, such as under counters.

In flight tests, parachutes and instrument payloads were carried aloft by small rockets. Descent times averaged about one hour and 45 minutes from ejection at 40 miles to touchdown.

## Photographing hot surfaces

A new technique of "hot-stage" microscopy has been developed so scientists can see what happens on the surface of a metal subjected to extremely high temperatures.

Walter C. McCrone Associates of Chicago report scientists may observe phase transformation phenomena, diffusion and evaporation, and reactions at temperatures above 3,600° F.

Photographs, still or movie, can be made of incandescent substances —matter generating and transmitting light but much too hot to reflect light. For example, the microsurface of the filament of a light bulb can be photographed by the method.

Still or motion pictures can be made while the temperature is rising or descending. In experiments at temperatures of 3,600° F, McCrone scientists report they could maintain temperatures with less than 20° F of variation.

The method uses resistance heating to obtain the desired temperature. If the metal being studied conducts electricity, it is mounted between two tungsten terminals in an evacuated chamber. If it does not conduct electricity, it is attached to a tungsten ribbon be-

tween two terminal blocks. A power supply of 200 amperes and 10 volts is used and adjustment of amperes controls the temperature.

Forty power magnification and photographic enlargement allows a picture of the surface to be blown up to 2,000 times the actual size.

A system of light filters is a key feature. Through filter selection, certain wavelengths of transmitted light can be absorbed to bring out contrast on the incandescent surface.

The technique will allow studies of materials under controlled atmospheres at high temperatures as well as in a vacuum. The desired atmospheres are introduced after evacuation of the heat chamber. By use of controlled atmospheres, scientists should be able to observe effects of high-temperature reactions as they occur.

### *Balloons for Apollo*

Balloons, one of man's first methods of exploring the atmosphere, will also aid in his early explorations of space. Goodyear Aerospace Corp. is developing and producing inflatable balloons to hold NASA's three-man Apollo spacecraft upright in water during recovery operations.

Each of the spheres, made of polyurethane-coated fabric, will be 43 inches in diameter and have a volume of 24 cubic feet. They will be hooked to the spacecraft with internally mounted cables. Each spacecraft will carry two operational spheres and one back-up.

The spheres will replace the inflatable flotation collar now fastened around the spacecraft after splashdown to stabilize it.

Goodyear Aerospace is also designing a device to inflate the spheres as soon as they land in water.

An engineer inspects spheres that will keep spacecraft seaworthy during recovery.

### Rare Earths for TV

A new flotation system will be used at the world's largest Rare Earths mine to produce high concentrates of Rare Earths. These are minerals sought by the fast-growing color television industry, as well as for other uses. The system, developed by the Molybdenum Corp. of America (Molycorp), is the only one in the country to use hot liquids to attain higher yields of Rare Earths.

Rare Earths consist of the 15 elements in the periodic table with

atomic numbers 57 through 71 plus Yttrium (atomic number 39). They sport such names as Cerium, Lanthanum, Dysprosium and Thulium. They are fairly abundant in the earth's crust and, as a group, are more abundant than copper, zinc, lead, tin, uranium or molybdenum. However, until ion exchange separation techniques were developed, their purity was not sufficiently high to permit their use commercially.

Molycorp is the only commercial plant in the U.S. to use a solvent extraction method of processing Rare Earths. One pound of a popular Rare Earth product named Europium Oxide requires more than 10,000 pounds of Rare Earth ore to be processed.

Phosphors containing Europium have solved a problem that plagued color television tube manufacturers for a long time. Color TV depends on three phosphors—red, blue and green. Red phosphors used previously created a dull color. To keep a balance with the weak red phosphors, blue and green phosphors had to be deliberately deadened. A dull color picture resulted. However, with a red phosphor containing Europium Oxide, the brightness of the picture is improved up to 40 percent and a truer red is produced.

Molycorp has contracted to produce 6,000 pounds of Europium Oxide annually, primarily for sale to the color TV industry.

Other uses for Rare Earths include polishing glass for camera and optical lenses and as additives in oil-cracking catalysts as well as in iron, steel and carbon arcs.

Hot liquids are used to extract Rare Earths at Molycorp's Mountain Pass, Calif., plant. Rare Earth oxide content at site is unusually high, graded about 10 percent.

# INVENTOR OF THE MONTH

## A better way to hold things together

Harvey Phipard holds a larger-than-life model of his Taptite three-cornered screw.

MANY patented inventions remain mere concepts for years, some of them forever. While Harvey F. Phipard's patent was pending more than a billion and a half of his Taptite screws were manufactured in this country. He knows that a lot more were made in foreign countries, but the statistics are lacking.

The *Science Digest* Inventor of the Month recently received Patent 3,195,156, prosaically entitled Method of Producing Thread Swaging Devices. He assigned it to Research Engineering & Manufacturing, Inc., New Bedford, Mass., for which he is director of engineering. It is a subsidiary of the Continental Screw Company.

The signal success of the three-cornered screw is attributed to the fact that it is self-tapping and rolls its own threads in a wide variety of metals and plastics without making cuttings or chips. Self-tapping means that it does not need the customary preparation of the hole with a tap, or thread-cutting tool.

Continental, a half dozen U.S. licensees and at least eight abroad are producing the lobular Taptites. In lengths from one-eighth inch to eight inches, they hold together washing machine transmissions, automobile starters and fuel pumps, gas range burners, hand power tools, file cabinets and various electric appliances.

The American customers include the Big Three automotive companies, General Electric, Westinghouse Electric and Western Electric. Continental is confident that its Taptites will take over a major part of the metal fastening market in the U. S.

Harvey Phipard was born in Brooklyn in 1915. At age 20, he was a student at Heidelberg University, and in 1937 M.I.T. awarded him a bachelor of science. The next year he married and went to work for Continental. Since then he has collected many foreign and domestic patents on fasteners. The Phipards live in South Dartmouth, Mass., and Harvey is a director of the New Bedford Yacht Club.

—*Stacy V. Jones*

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# TIPS AND TRENDS

IT'S BOUND TO COME--the metric system, that is. When, depends on the cost. The Department of Commerce is authorized to analyze that by legislation recently before the Congress. U.S. science uses kilos, centimeters and liters like the rest of the world, because reckoning in them is so simple. Some industries will suffer hardship by having to convert. The best guess is that conversion, when it comes, will be gradual.

UNDERGROUND A-BLASTS FOR INDUSTRY. That is the latest in atomic energy for peaceful uses. Under a proposal by the El Paso Natural Gas Company, nuclear blasts would be set off to tap natural gas beds in New Mexico. These are fields where the fine pores of sandstone and limestone may become so clogged, the gas won't flow to a well. An A-blast would open up a field where it's uneconomical to use ordinary explosives. It is said the yield could increase 700 p.c.

SIGNIFICANT MILESTONE: Spending for peaceful uses of atomic energy is now as great in the U.S. as it is for military uses.

NEW KIND OF NUCLEAR POWER STATION. It will be built by the British at Dungeness. With the greatest commercial output anywhere, it will use the Advanced Gas Cooled Reactor system in preference to U.S.-designed water moderated reactors. A.G.R. power is 10 p.c. cheaper, it's said, because the system makes more compact reactors possible. Also A.G.R. can be refueled on load.

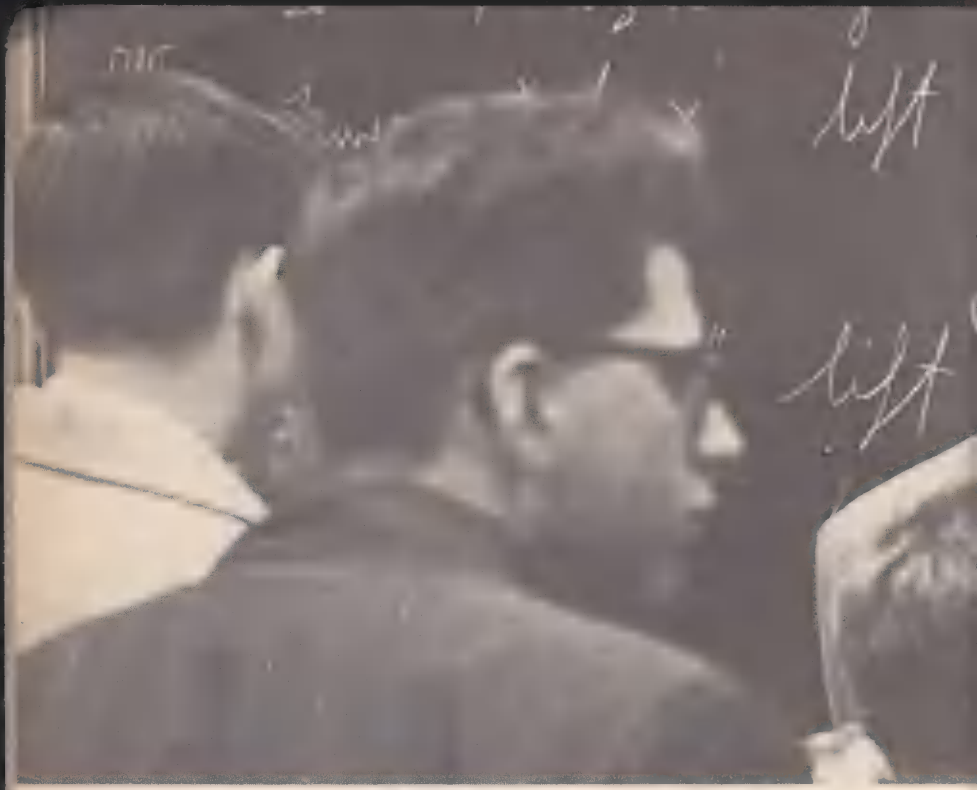
WATCH YOUR SULFUR DIOXIDE. You can't see it because it's colorless, but you may be producing it if you burn coal or heavy fuel oil. If you are, says the Public Health Service, you are creating a serious hazard to health and it will crack down on you.

WILL MAN FLY TO THE MOON NEXT YEAR? He may if a plan being studied by NASA is OK'd. No actual moon landing is planned by the U.S. before 1969, but NASA believes a Gemini spacecraft with two astronauts could be put into orbit so it circles the moon and then returns. The round trip would take six days and beat the Russians to a feat it's thought they're planning for 1967 or 1968.

NEW HOPE FOR LAKE ERIE. The states around Lake Erie will do something at last to make Erie a lake once more instead of a sewer. Effluents with 35 million pounds of contaminants pour into the basin each day, fouling the water and draining much of its oxygen. Result: whole species of fish obliterated and proliferating algae. It's believed that improved treatment of wastes and other measures could clean up the lake in 8 years. Worst offenders: New York and Michigan, although no state is blameless.

PESTICIDES ARE SAFER. Tough Federal regulations are forcing producers of pesticides to reduce contamination of foods and nature to new lows. The Wall Street Journal says companies are spending more on research.

INVENTORS, NOTE: The American Society of Inventors, Philadelphia, wants to contact young people with inventions to offer aid.

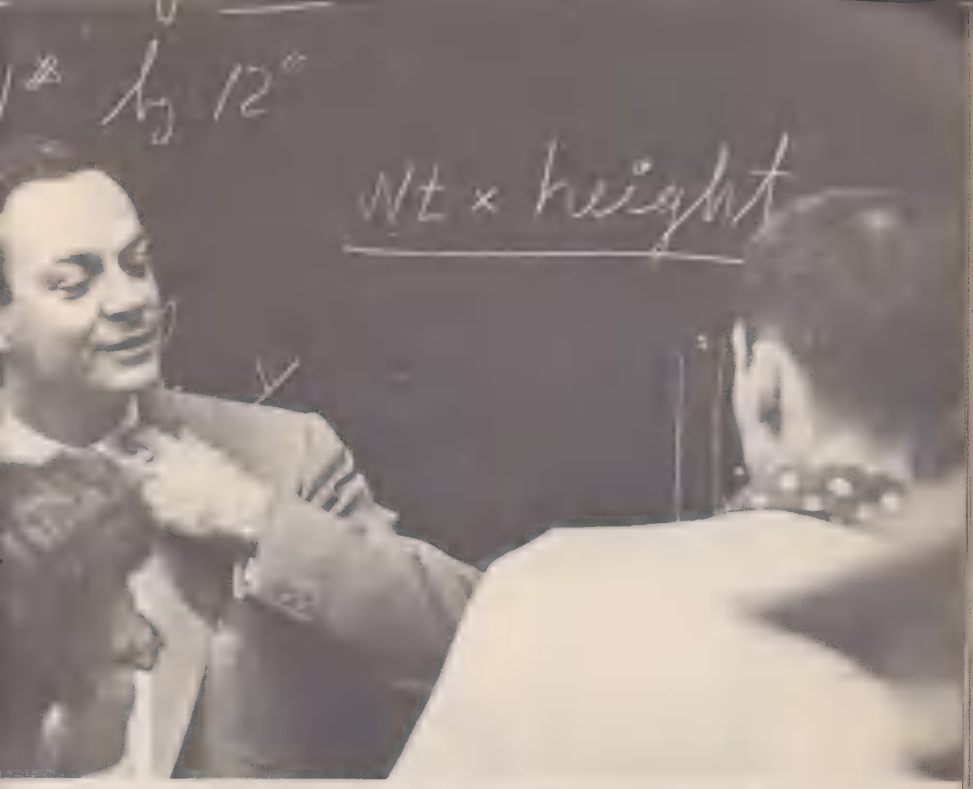


The excitement of learning—by solving

# Caltech—

**This is the school where the students of one professor won five Nobel Prizes. The first in a series on America's top science schools, this report will be followed by others in upcoming issues of Science Digest.**

Royal palms flank Chemical Engineering Lab. Campus is both exotic and prosaic.




problems—marks classes like this one taught by Physics Prof. Richard P. Feynman.

# campus for genius

WHEN the class of 1969 arrives at Caltech in Pasadena, Calif., this fall, the first thing it will do is leave.

The reason: "They're all so damned bright," as one professor put it. Caltech freshmen are almost invariably students who ranked No. 1 or 2 in high school. So it's policy to bus them 90 miles east to the San Bernardino Mountains, where they're put through a three-day session of ego-deflating speeches.

In any event, it's doubtful that any cocky student could long survive one of the most sought-after, and toughest, educations any American university has to offer.

California Institute of Technology is one school bent on turning out, not bookworms, but whole men. "Of course, we want genius," says Caltech's President, Dr. Lee A. DuBridge. "We also need the man whose intellectual power is combined with leadership and understanding."

So far, Caltech has got what it wants. With 64 percent of its alumni not yet 40, one in every 16 today is a top executive. And the average alumnus makes $1800 more a year than the average college graduate.

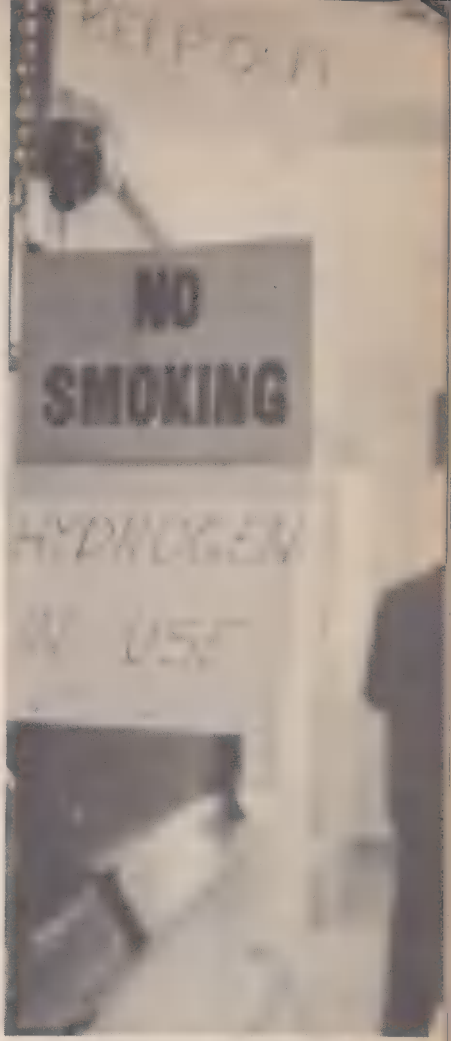
Above: Synchrotron Laboratory has been scene of basic particle physics research. Caltech's Robert A. Millikan did pioneer work in that area that won him worldwide recognition. Below: Analysis of space-age metals typifies Institute's work. This is Caltech's high-temperature X-ray spectrometer. Because it pursues basic research, Institute has almost no huge equipment. Exceptions: its Mt. Wilson, Mt. Palomar and Owens Valley telescopes.

THE PURPOSE of many schools is to teach what is known. At Caltech, the purpose is also to find out what is not known.

The Institute has an unusually small student body—700 undergraduates, all men, and 750 graduate students, of whom about a dozen are women. It also has, in proportion, an unusually large faculty—about 550.

At all levels, research goes hand in hand with teaching. Some 900 research projects worth $10 million are in progress. The money isn't perhaps as much as it might

Flume in Hydraulics Lab helps study of water flow. Like seismology, in which Institute excels, subject is of special interest in flood-, quake-prone California.




Aeronautics Lab is a feature of Caltech, which pioneered in transsonic transport design and JATO rockets. In optical and radio astronomy, Institute has no equal.

be. That's because the Institute purposely eschews the big projects. "We prefer," says one of its members, "to find the principles."

The principles found at Caltech make an impressive list: Development, for example, of solid rocket fuels and analog computers; discovery of those fundamental particles of matter, the positron and mumeson. In biology, chemistry and geology, too, the Institute has made fundamental findings.

Yet significantly, this year, Caltech for the first time will offer a bachelor's degree in humanities.

CALTECH is about a 15-minute drive north of downtown Los Angeles, four miles from the San Gabriel Mountains. Surrounding Pasadena and neighboring communities abound in beautiful houses and gardens, the homes of many wealthy families in the L. A. area.

That helps explain Caltech, for the school got its start as an independent, privately endowed institution with the backing of a Pasadena philanthropist. Its scientific excellence has won it local and national backing ever since.

One of new buildings, in Spanish modern, is Winnett Student Center, a donation.

Hong Kong student (many are from abroad) attends classes in plain cement building.

Administration occupies one of original buildings. School was founded in 1891.

Though occupying only four blocks, campus facilities are expanding fast, as below.

Above: Architectural pride of Caltech is recently completed Beckman Auditorium, designe by Edward D. Stone. It seats 1,200 people and also has an interfaith chapel. Below Famous Jet Propulsion Laboratory, which is masterminding shots to moon an Mars, is operated by Caltech for NASA. It's about four miles from main campus

A list of past and present faculty members at Caltech reads like a who's who of American science. It includes (besides those mentioned elsewhere): rocket expert the late Theodore von Karman, chemist Linus Pauling and physicists Murray Gell-Mann, Edwin McMillan and William Shockley, who did early transistor research.

William R. Smythe, Professor Emeritus of Physics, taught five students who went on to become winners of Nobel Prizes.

Dr. Ray D. Owen heads Division of Biology. He continues genetics tradition started by, among others, George W. Beadle.

President Lee A. DuBridge, center, above, fosters idea world needs leaders versed in science. He seeks to turn out men with "breadth of view sorely needed" today.

Faculty Club offers serenity (below) and also the opportunity for a constant exchange of ideas. Lunch tables are often reserved for men with common interests.

Provost Dr. Robert F. Bacher headed Division of Physics, Mathematics and Astronomy, was at Los Alamos during war.

Dr. Carl D. Anderson, who heads Division of Physics today, was first Caltech Nobel Laureate. He discovered the positron.

Dr. Clark B. Millikan directs Graduate Aeronautical Laboratories. He's son of Robert A. Millikan, former Caltech head.

# The common cold: a hopeful, new look

by Stanley L. Englebardt

ALTHOUGH reports of "cures for the common cold" have been a dime a dozen over the past ten years, now at last we have something really important to talk about: a vaccine that has proved 100 percent effective against an extremely virulent form of acute respiratory viral disease.

The vaccine, developed by scientists at the National Institutes of Health, was tested on a large group of recruits at the Parris Island Marine Training Center and at Camp Lejeune, North Carolina. Although there are many forms of respiratory viral infection—and the present vaccine is effective against only one of them—scientists consider this to be a major breakthrough because of the method by which it works.

Up to now "anti-cold" vaccines have been designed to produce controlled infections in the respiratory area. Under the concept of this new vaccine, however, the respiratory system is by-passed in favor of the lower intestinal tract. There the vaccine virus stimulates the body's immunity system to produce antibodies. These antibodies then are available to neutralize—or fight—any of the same type of particles that may later invade the body.

To fully appreciate this breakthrough, some insight into the nature of virus particles is in order. Unlike bacteria, which can thrive and multiply in a wide variety of mediums, virus particles are extremely selective about where they live and reproduce. The virus that causes hepatitis, for example, is highly partial toward liver cells. Influenza viruses gravitate toward lung cells. The tobacco mosaic virus will infect only the cells of tobacco plants, and has no effect whatsoever on humans or animals. By the same token, there are viruses that hit only cats, and not dogs or plants or humans; and viruses that attack dogs and no other type of organism.

**In their war on cold viruses, researchers have worked on thousands of human volunteers. Result: a revolutionary vaccine technique that may ultimately bring about a way to prevent colds.**

For this reason, previous vaccines were designed to deliver their contents directly and specifically to a particular group of cells. Some of these vaccines are composed of killed virus particles; others contain attenuated (live, but relatively docile) forms of the disease. In either case, the particles head for their favorite cellular nesting place, multiply prodigiously and create a (hopefully) mild infection. This infection, in turn, causes the body to produce antibodies which then fight future natural reinfections.

Edward Jenner was the first to take advantage of this phenomenon. During the late 18th century, he observed that most milkmaids were immune to the smallpox epidemics which swept the country from time to time and these same girls usually bore on their hands the characteristic marks of cowpox. Cowpox is a disease of cows' udders which, in humans, causes a mild infection and smallpox-like blisters. Jenner made a serum from fluid contained in cowpox pustules and "vaccinated" volunteers with it. The result: a mild cowpox infection but immunity to the far more devastating effects of smallpox.

Since then vaccines have been based on the principle of creating a mild form of infection in order to stimulate antibody production. This has worked in some cases—smallpox, polio, yellow fever and mumps to name a few—but has failed in others. Most common respiratory ailments fall into this latter category.

There are usually two reasons why anti-cold vaccines fail: first, the so-called controlled infection often turns out to be as severe as anything the patient might pick up himself; and, secondly, the antibodies generated by the vaccine provide only temporary immunity at best.

A discouraging picture—yet the need for effective respiratory vac-

## As one researcher for the N.I.H. has put it, "The cold must go."

cines has never been greater. "Respiratory diseases result in more disability and time lost . . . than all other acute diseases combined," says Dr. Dorland J. Davis, director of the National Institute of Allergy and Infectious Diseases. "They range from the common cold . . . to severe, fatal pneumonias. They are ailments that most commonly demand the attention of a physician [and] they are estimated to cost the American people one billion dollars a year . . . ."

For these reasons, Congress authorized funds in 1962 for a five-pronged attack on respiratory viral diseases. As one N.I.H. researcher put it: "The cold must go." And although sneezes and sniffles are still with us, important progress has been made in each of the five major areas.

The most dramatic results to date have been achieved in the area of adenoviruses. These are flu-like epidemics which rage through military camps, prisons and college campuses. Exactly why adenoviruses prefer young adults is still a mystery. But—thanks to the new breakthrough—this form of respiratory ailment is now on its way out.

The new mixture, called adenovirus type 4 vaccine, comes in the form of a coated capsule which prevents the vaccine from being released until it reaches the intestinal tract. There it causes a symptom-free infection that stimulates the production of antibodies. So far, these antibodies appear to give long-term—if not life-long—immunity from the "bug."

But will this technique work against other forms of respiratory illness—particularly so-called common colds?

### Testing technique

The answer is both no and yes. "No" in that this vaccine is designed only for one of the almost 150 specific forms of respiratory viruses so far identified. "Yes" in the sense that it offers an important new means for experimentation.

The other prongs of the N.I.H. attack concern four other groups of common respiratory ailments:

The most important group are the respiratory syncytial viruses, which cause severe bronchiolitis and pneumonia in children. These "bugs" can be killers. To date, researchers have been able to produce similar infections in baboons —but they haven't uncovered a means for preventing it. The new delayed action capsule, however, may offer a solution.

Another group is the para-influenza viruses which are responsible for croup and pneumonia in infants. Some progress has been made here in the form of an injectable vaccine. Physicians, however,

would much prefer to use a capsule in order to avoid inducing a mild respiratory area infection and having to give infants too many injections. Here, too, the capsule approach offers promise.

The third group, known as mycoplasma pneumoniae, isn't exactly a virus—but lives in a sort of half-world between viruses and bacteria. Mycoplasma, like the adenoviruses, attack mainly young adults. But so far, the most promising avenue to prevention appears to be along the familiar injected vaccine route.

Finally there are the rhinoviruses, which produce the symptoms most of us refer to as a "common cold." The big problem here is volume. N.I.H. researchers have already identified more than 30 viruses in this class—and some say the figure could be over 70. Vaccines have been developed against some members of the rhinovirus family, but obviously it would be impossible to develop serums—and inject them—against all forms. Therefore the big hope today is the type of capsule that has proven so successful in adenovirus prevention.

### Cross-reactivity needed

How will this work?

"We hope that antigenic relationships may be found between several groups of respiratory viruses," explains Dr. Davis. "With such relationships, there may be sufficient cross-reactivity to permit some degree of blanket protection against many respiratory virus agents. And this protection may be increased by incorporating the vaccine in an adjuvant (i.e. coated capsule) that will release antigen slowly, continue to stimulate antibodies, and, as a result, prolong the effect of the vaccine."

The common cold—and many of its tougher kin—are not yet under control. Yet the ability to stimulate production of antibodies without actually causing respiratory infection was a powerful blow. Whether or not it is the knockout punch remains to be seen.

### *Tooth with a mission*

IT LOOKS like an ordinary "bridge" of a first molar, but crammed into a recently designed replacement tooth are six miniature radio stations, 28 electronic components and two rechargeable batteries. Circuits are linked with gold wire of microscopic diameter. Two University of Michigan researchers, I. S. Scott and Dr. M. M. Ash, designed the tooth, which can chew food and measure pressures and direction of forces impinging on its surface. It then broadcasts detailed information to waiting monitors within a one-foot range. A volunteer ate various foods and the miniaturized equipment broadcast a stream of information about the play of surface forces. With data concerning surface strains and stresses, dentists will be able to design better replacements for lost teeth.

# Why nobody wants women in science

The author, a research bacteriologist, peers at a slide.

by Ruth B. Kundsin, Sc.D.

PREJUDICE is covert behavior that cannot be aired, evaluated, or exposed. It springs from emotion and elicits an emotional response. Although it may be recognized by the victim, it cannot be revealed because it is intangible.

Discrimination on the other hand is overt, can be discussed objectively—as the number of individuals employed, dollars earned, positions held; and therefore is considered a more acceptable approach in any discussion.

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It is my contention that women in the United States have been victims of both prejudice and discrimination; the women in science more so than others.

Striving for a career in predominantly masculine professions is not as rewarding for a woman, psychologically or socially, as it is for a man. She is not recognized for her achievements but singled out and observed as an oddity. Her energies are of necessity directed toward trying to act appropriately in any situation; not too feminine, nor too masculine, not too dedicated, nor too relaxed. Because she is frequently the lone female in a professional gathering, she feels that she

represents her whole sex and with this responsibility in mind, endeavors to divine what is expected of her. Since there is no pattern of accepted behavior, she will be criticized whatever she does, not only by men, but women as well. David Riesman has pointed out that women who lack the courage to launch out into satisfying careers of their own will bitterly resent and envy the ones who do.

The woman in science is, therefore, at a distinct disadvantage. The more highly accomplished she is, the greater the resentment from ancillary personnel, particularly of her own sex. If she has a sprinkling of Harlowian traits, her male colleagues are flirtatious. If she looks like a benevolent moose, they are merciless and their appraisal of her appearance takes precedence over what she has to say. The emotional reaction, sensed by both sexes, impedes her acceptance as an equal, an independent scientist, unreservedly, unselfconsciously.

Throughout history, raising children has been incidental to family living. In agrarian cultures the woman worked side by side with her husband in the fields. Infants were brought with them and propped up against a haystack. Older children herded the cattle. Our own pioneer women were partners and active participants in the exponential growth of the nation. But now, for the first time in the recorded history of the world, American women have been relegated by our culture to a full time job of child rearing. Mothers are expected to stay home with small children, and the pressure of convention even extends to mothers of teen-age children.

## Working population

Although women constitute 34 percent of the working population, as of spring, 1962, their work is of the secretarial, clerical, or service type, requiring little or no training or experience. They are predominantly young women who have not yet married or older women who have raised their families.

The few women in science or engineering who hold positions in which graduate education is required receive salaries $2500 to $3000 less per year than men receive in the same positions with similar training and experience.

Since 1920, the percentage of women holding doctorates has declined in the physical sciences, biological sciences, arts and professions. The only increase has been in education, in which the number of women holders of doctorates has risen from 15 percent in 1920 to 19 percent in 1961. An editorial in *Science* observed that the percentage of women in engineering, natural sciences and the social sciences has declined in the period from 1950 to 1960, a decade in which efforts were supposedly being made to utilize the talents of our capable women.

These are the bare statistics. For an explanation, one must turn to

## A survey found most women see themselves as scenery for the family.

the sociologist, Alice B. Rossi, professor of human development at the University of Chicago, who investigated the reasons why so few women go into engineering, medicine, or science. She offers the following observations: a large proportion of women with advanced training are unmarried, and the proportion increases with each degree beyond the bachelor's. To remain unmarried in our American society is unfortunately considered evidence of personal inadequacy. The young girl who is anxious to marry will not, therefore, train for professions in which spinsterhood is the rule. However, studies have revealed that a woman does not become less attractive to men with each succeeding degree that she acquires. She does become more selective in her choice of a mate. A woman with a doctorate seeks an intellectual peer as her life's companion. On the other hand, men with increasing education were not found to be as selective.

In her survey of 3500 college graduates, Dr. Rossi found that women could be grouped in three categories; homemakers, traditionals and pioneers. The homemakers had marriage as their only career goal. Three years following graduation, 90 percent were married. The traditionals were women whose career goals were in professions considered predominantly feminine. These were teachers in elementary or secondary schools, nurses, social workers, librarians, or home economists. Two thirds of these women were married within three years following graduation. The pioneers were women seeking careers in occupations considered predominantly masculine: law, medicine, engineering, science, dentistry, architecture, and business management. One half of these were married within three years after graduation. Since the traditionals and homemakers were found to be quite similar, they were grouped together.

### Further breakdown

The two final categories were characterized further. Their childhood relationships with family and friends differed. The homemaker-traditionals had very strong family ties, enjoyed visiting family and friends, delighted in the company of young children. They considered themselves to be dependent, and socially competitive. They thought that marriage was the most impor-

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Dr. Kundsin is married and the mother of two children. She is research associate in bacteriology in the department of surgery, and on the research associate staff at the Peter Bent Brigham Hospital. She was graduated from Hunter College and received her M.A. from Boston University School of Medicine and her doctor of science degree from the Harvard School of Public Health.

Employment of women in sciences and engineering, 1950 and 1960, as percentage of total personnel, and rate of increase of each sex. 1960 CENSUS OF POPULATION, Vol. 1, Table 202.

| Occupation | Female (%) | | Increase (%) | |
|---|---|---|---|---|
| | 1950 | 1960 | Female | Male |
| Biologists | 28 | 27 | 38.2 | 56.2 |
| Chemists | 10 | 9 | — 3.6 | 13.5 |
| Geologists, geophysicists | 6 | 2 | —27.3 | 81.1 |
| Mathematicians | 38 | 26 | 209.8 | 428.1 |
| Physicists | 6 | 4 | 20.2 | 92.5 |
| All natural scientists | 11 | 9 | 10.4 | 30.0 |
| All engineers | 1.2 | 0.8 | 11.0 | 64.3 |

tant single event in their lives.

The pioneers were not as closely attached to family and friends and did not see them as frequently. They did not enjoy the companionship of young children as much and considered themselves to be independent and occupationally competitive. The most important event in their lives was childbearing. The advent of children meant dependency and occupational compromises.

Nevertheless, both types of women were agreed as to what constituted success for themselves. To be the mother of accomplished children was the primary goal, followed by that of the possession of a prominent husband.

These pathetic revelations signify that success for all women is not interpreted in terms of personal goals. Success is associated with children and husband. They have ceased to aspire for themselves. They are completely self-effacing, simply a backdrop or scenery for the rest of the family.

Americans have rigid notions as to what constitutes approved occupations for each sex. We consider a male dancer an oddity, a female wrestler or crane operator equally curious.

Other cultures do not, however, share this view. A brief visit to the Soviet Union was an opportunity to observe their pattern of life. It was not unusual to see women engaged in occupations which we consider masculine. Fragile girls with bouffant hairdos drove buses and operated gates at railroad crossings, while older women swept the streets with brooms made of twigs. The presence of many women in prestige occupations and the complete acceptance of them were obvious characteristics of Soviet society. This was illustrated by a tour of a hospital, the Sixth Polyclinic of Riga, where the director, a pleasant, sturdy female physician, escorted a group of visitors through the many buildings of the hospital. The department heads we encoun-

## P.T.A. meetings and futile housework lead to the "tired mother" syndrome.

tered were predominantly women, and we were told that 75 percent of practicing physicians were women. This was not considered unusual—except by the visitors.

A more subtle cultural difference could be discerned in the male-female relationships, which cannot be evaluated numerically like the numbers of physicians. This was reflected by the complete lack of coyness, giggling, and selfconscious behavior of teen-age girls. Wherever we looked, in restaurants, on the street, or while working together, camaraderie existed between both sexes at all ages. Prominent men spoke of the activities of their equally prominent wives.

### Küche, kinder, kirche

My statistical training does not permit me to believe that male intelligence alone occupies the right-hand side of the bell-shaped curve of I.Q., relegating the female to the left-hand side. The only explanation is that as a nation we have evolved a philosophy similar to the German concept for the role of women; only with typical American ingenuity we have added refinements. Thus "Küche" has become gourmet cooking, interior decorating, and the ceremonial futility of housework. "Kinder" has become preoccupation with Spock, Gesell, Freud, and sexual fulfillment, while "Kirche" is not only church suppers and rummage sales but the constant admonition that "the family that prays together stays together."

I am convinced that the educated woman who optimistically spent her youth majoring in psychology, sociology, or political science is not going to find the full meaning of living in endless P.T.A. meetings, synthetic charities, and church sales. The "Tired Mother" syndrome reported in the *Journal of the Iowa Medical Society* is the result. Because the wife finds little personal satisfaction in her work in the home, she becomes tired, depressed, loses weight, cannot sleep, and eventually finds her way to the physician.

Attitudes are as infectious as the common cold. Submissive, self-effacing mothers who are confused about their own roles in the family and the community are not going to raise pioneer daughters. They will rear submissive, self-effacing daughters who will not become scientists, scholars, or doctors. The growing girl who looks about her for women models for her life goals sees career women only as teachers on the elementary or high school level, occasionally on the college level. Because she does not see women actively practicing assorted professions about her, her goals are limited by what she does see.

Is there a solution? The solution to this problem is obviously as complex as its cause. The core is prejudice and its expression discrimination. Progress directed toward legislating equality is helpful, but superficial and palliative. It attacks discrimination but not basic prejudice. In order to understand prejudice one must deal with people and their emotions.

Studies of the successful feminine pioneers in our society—and they do exist—would furnish clues as to the type of family, the interpersonal relationships that lead to extraordinary motivation. The background of the women graduates of Harvard Medical School, an unusually dedicated group, would be revealing.

Masculine help is also necessary. Because women have accepted unquestioningly the standards that men have set for them, almost all masculine understanding and encouragement will be of paramount significance. Fathers can and should urge their bright daughters to continue their education toward goals of self realization. Husbands can put up with minor inconveniences associated with the working wife and revel in the greater fullness and joy in living that arises from a happy, independent woman who is utilizing her talents completely and arrives home with sparkling, challenging experiences of her own to tell and share.

Couldn't it be that the love of such a woman is a wondrous, exciting experience? Or does the American male ego really need a full time female slave in residence?

Educators should face the paradox of an educational system that prepares men and women identically for careers that our society limits to one sex.

### Why not equality?

I have deliberately attempted to write a provocative article on a subject that is real, important, and controversial. No complaint or self-pity is intended. I completely enjoy being a woman, but deeply resent not being offered the same opportunities men have.

The woman currently working in science has met and overcome a mountain of obstacles. She has flouted convention in her goals and her training and continues to do so daily in her occupation. It takes a hardy spirit to stand erect with such a burden.

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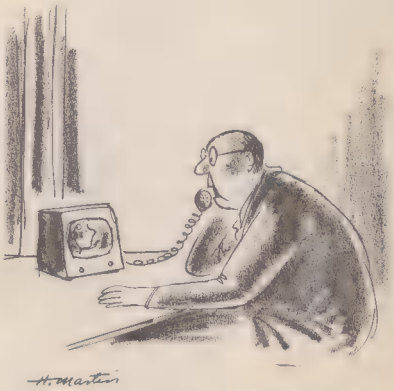


"Operator, I keep dialing area code 609-924-6423, but all I get is Jeanette McDonald and Nelson Eddy!"

# Monkeys for the moon

ALTHOUGH billions of dollars are allocated to put a man on the moon, the first intelligent creature to get a closeup view is slated to be a chimpanzee.

Some 83 chimps are undergoing training by a staff of 85 technicians at Holloman Air Force Base in New Mexico. They will provide data on the effects of extended space flight. Some will be passengers on earth-orbiting rockets, some will be the first aboard a space platform between the earth and moon and some will circle the moon itself. If a rocket can be put on the moon and retrieved automatically, one or more at the base may land on the moon, according to George Meeter, a program director at Holloman.

The apes will perform the same tasks in space that they are learning on earth. Their efficiency and reactions will be telemetered back to earth during flight.

These chimps are more learned than their early mates in space. They are taught to operate more complicated devices and to count as high as eight. In 1961, astro-apes could count only to three.

Left: First American passengers to circle, perhaps land on, the moon, will be chimps now between four and five years of age.

Right: A chimp curls his toes impatiently during a test of the oxygen apparatus. He is one of 83 astro-monkeys training.

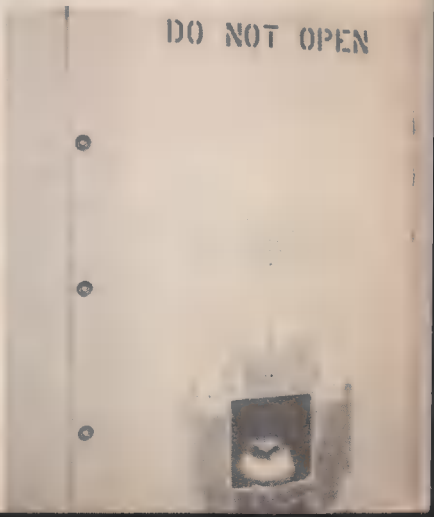
Above: Technicians lace a chimp into a space suit. It is attached to space capsule to hold occupant securely in place.

Below: Reclining test capsules have control panel, gauges. Training mockups are made to look as realistic as possible.

Above: Chimp's reactions to flight simulation are monitored by TV.

Left: Straps hold chimp in reclining position during some tests.

Below: Cape Kennedy-bound chimp peers out slot of steel crate.



# Hypnosis: what it can and can't cure

**Hypnosis can replace drugs during surgery and childbirth. It can be a shortcut to cope with combat neurosis. Its misuse can cause suicide.**

by Arthur J. Snider

WHEN Pat Collins, the blonde stage hypnotist, goes into her night club act of suspending a member of the audience between two chairs, the patrons howl, but the professional therapists fume.

They are trying to reclaim hypnosis from theatrical trappings and restore it to the clinic as a treatment tool. Amusing stage antics impede their efforts, they believe. As it is, patients often think that submitting to hypnosis is akin to putting themselves in the power of a real-life Rasputin.

The fact is that hypnosis today is a legitimate, effective adjunct of therapy that is widely used in the medical profession.

For more than 170 years practitioners of medical hypnosis have sought to make the technique respectable and acceptable. They suffered a serious setback in the late eighteenth century when their patron saint, Franz Mesmer, a Viennese physician, was called a charlatan for practicing hypnosis. He died in obscurity, although his name lives in the term "mesmerize."

In the nineteenth century, hypnosis enjoyed a revival only to suffer rejection when Sigmund Freud, father of psychoanalysis, announced he was abandoning its use.

Once again, in World War I, a flash of interest occurred, only to fade. In World War II, when psychiatrists were faced with the need of a short-cut technique to deal with combat neurosis, they rediscovered hypnosis. This time, the interest appears to be sustained.

Support has come from the American Medical Association which, after years of skepticism, issued a report in 1958 endorsing the responsible use of hypnosis by those qualified through training.

Today, several thousand babies are delivered each year with the mother in a hypnotic trance. Sur-

UPI Photo

A 19-year-old Italian girl manages to smile, joke and chat during an appendectomy. She was the first patient in Italy to undergo surgery under hypnotic anesthesia. Her casual banter was recorded.

## Like an actor, a hypnotized person takes cues, re-establishes control.

geons can perform such major operations as removing a thyroid gland, opening an abdomen or amputating a cancerous breast without using anesthesia. Patients who never before have been able to enter a dentist's office for fear of the anesthetic needle and the drill are having their teeth fixed. So widespread is its use, many conservative practitioners are fearful hypnosis will become oversold and the public led to expect quick therapeutic triumphs every time.

How does hypnosis work?

In one respect, hypnosis is like the state of ordinary sleep when the conscious thoughts of the waking hours have been put aside, leaving the mental area clear for unconscious thoughts to come to the fore. There is an important difference, however. Whereas the mental shifting comes automatically in sleep, it is forced by the therapist in hypnosis. A further difference is that the patient holds on to the ability to hear, understand, feel and sense.

After reaching the unconscious mind, the therapist implants suggestions designed to influence the patient favorably when he returns to a waking state. The patient does not surrender his will. He retains the right to accept or reject the suggestions.

Dr. Milton Erickson, editor of *The American Journal of Clinical Hypnosis*, draws a similarity between a hypnotized person and an actor who is willing to take his cues from the director of a play while on stage but when off stage, in real life, re-establishes his own control of behavior.

Dr. Seymour Hershman, a founder of the American Society of Clinical Hypnosis, compares the hypnotic state to a music lover who closes his eyes at a concert to better pick out the different instrumentations. He narrows his field of awareness by removing visual distractions. His attention is completely taken up by what he wishes to focus on.

A movie patron so intent on the picture he pays no attention to the noisy munching of popcorn beside him is in a sense hypnotized. A fisherman sitting in a boat for several hours, oblivious to the world around him, has been subjected to a type of hypnotism by the shimmering and dancing water.

In spite of its misuse by cafe performers and its occasional failure in the hands of well-intentioned but incompetent therapists, hypnosis has established its validity in several medical and paramedical areas. Among them are:

**Childbirth:** Here hypnosis finds its most popular use. Since it does not depress uterine activity as do some commonly-used anesthetic drugs, a marked shortening of the

labor period is usually obtained. Dr. Milton Abramson and Psychologist William Heron, writing in the *American Journal of Obstetrics and Gynecology,* reported an average reduction of two hours in the first stage of labor.

Hypnosis is often used when a mother has a cardiac condition or tuberculosis and cannot tolerate drug anesthesia. It has no depressive effect on the infant's respiratory and nervous system and thus enhances the safety of birth, the most hazardous event in an individual's life.

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*Facts about hypnosis: Most people can be hypnotized. But usually, they must want to be. Hypnosis can vary in degree between a light spell and a deep trance. Many people can hypnotize themselves, but effective work takes practice.*

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The anesthesia degree is easily controlled. If it needs to be lightened or deepened, a simple suggestion will accomplish the goal. When chemical agents are used, they can be counteracted only by other drugs, by oxygen or by time.

Some women cannot be deeply hypnotized. Therefore, a combination of hypnosis and a drug is used. "Some patients will require no chemical anesthesia, others will require 10, 20, 50, or even 90 percent as much as they would have required if they had not learned hypnosis," Dr. Hershman points out. "But even when the amount of anesthesia is reduced only 10 percent, the patient is benefitted."

In a report on 850 deliveries, Dr. Ralph V. August of Muskegon, Mich., said only five p. c. needed drugs and hypnoanesthesia.

Some women become so skilled in undergoing hypnosis, they are able to enter a deep trance at their own volition. The advantage is the patient's ability to select the depth of the hypnotic state, according to Dr. Donald Coulton of Bangor, Maine.

Dr. William Kroger, Los Angeles obstetrician, has hypnotized several of his patients in labor by long distance telephone when an engagement has taken him out of the city.

**Surgery:** Hysterectomies, thyroid removal, abdominal operations and even heart operations have been performed with hypnosis as the anesthetic. At Cedars of Lebanon Hospital, a 14-year-old deaf girl underwent a five-hour operation during which her heart was opened and circulation maintained with a heart-lung machine. The child wore a hearing aid in order to respond to hypnotist's suggestions during the surgery.

A cataract extraction was done under hypnosis in a patient who had been unable to undergo the operation previously because of sensitivity to drugs.

A surgeon amputated both breasts in a cancer patient while she showed no sign of pain or distress. Many tonsillectomies and appendices have been done under hypnoanesthesia.

Two Indianapolis surgeons des-

# Hypnosis can aid hemorrhage control, patient fatigue, eliminate gagging.

cribed in the *Journal of the American Medical Association* their operation on a 38-year-old man to relieve epileptic attacks caused by an accidental gunshot wound in the forehead. General chemical anesthesia was ruled out because of the need to monitor electrical activity of the brain. Under local anesthesia, the patient's uncooperative disposition might have proved a problem.

In emergency rooms, hundreds of fractures and dislocations have been set, foreign bodies removed, lacerations sutured and abscesses drained, particularly when it has been found the patient had just eaten a heavy meal and might aspirate food into the lungs under drug anesthesia.

An unusual use of hypnosis in plastic surgery was disclosed by a hospital in Salisbury, England. To repair a portion of the right foot lost in an accident, it was necessary to obtain tissue from the abdomen by way of the forearm. In the first of a two-stage operation, it was necessary to keep the left arm locked across the abdomen for three weeks. After that graft had taken, it was necessary to hold the drawn-up right foot in tight contact with the abdomen for four weeks. Hypnosis permitted the patient to maintain the rigid and unnatural positions without discomfort.

"Hypnoanesthesia is no longer an experiment," says Dr. Milton J. Marmer of Los Angeles. "With it, virtually every body cavity has been entered and almost every organ operated on."

**Dentistry:** Hypnosis has been the answer for the nervous patient who fears the anesthetic needle. It also is useful for patients who set up defense mechanisms to postpone the technical procedures. These include the head-bobber, tongue-explorer, conversationalist and nose scratcher. It is helpful to those patients who do not submit to dental treatment easily and who repeatedly break appointments, says Dr. Irving Secter of Chicago.

There is also some evidence that better control of hemorrhage can be obtained in some patients but not all. Dr. Oscar N. Lucas of Philadelphia has performed more than 100 extractions on hemophiliacs without serious bleeding.

Hypnosis has been employed by dentists to control gagging and nausea and eliminating patient fatigue caused by long, drawn-out sessions in the dental chair. It has particular application to children who have been hypnotized as young as age two.

**Pain relief:** Sick, suffering patients have been able to live their last months of life free of pain resulting from cancer. Through use

of hypnosis rather than narcotics the patient is able to maintain a degree of cheerfulness and rational thinking. It also has been tried with varied degrees of success in painful conditions resulting from arthritis, bursitis, sprains and fractures.

**Skin diseases:** When skin disease is a reflection of underlying emotions, such as anger, hate and fear, Dr. Michael J. Scott, Seattle dermatologist, finds hypnosis a good tool. He has relieved itching due to psoriasis, urticaria, eczema and neurodermatitis. Some success has been claimed in removal of warts.

**Obesity:** There is no good treatment for over-eating except use of will-power, asserts Dr. Herbert Mann of San Jose, Calif., and hypnosis can strengthen the desire to reduce. He has used the technique on groups of overweight women.

"Our goal is to convert the craving for large quantities of fattening food to an appreciation of the delight in learning to enjoy subtle flavors of small portions of non-fattening foods, to take delight in creating and serving attractive salads, fruits and high protein food," he says.

"We encourage the patient to eat slowly and to take pleasure in savoring each small bite of food, to indulge the palate rather than the appetite."

Of 27 patients who responded to hypnosis, Dr. Murray Elkins of Howard Beach, N. Y., said only eight were successful in maintaining their weight loss. He concluded that the "time, energy and expense of trying to lose weight by this method are not justifiable."

**Habits:** Dr. Hershman describes a woman patient, 44, who smoked 44 to 50 cigarets a day. She could not refrain from smoking more than 15 minutes at a time. When attending the theater she would leave her seat to smoke at frequent intervals. After three hypnotic sessions, she was down to 10 to 12 cigarets a day, her desired quota. A year later, she was still smoking no more than the self-imposed quota.

Others have reported lesser success in curbing smoking. The impact of hypnosis on this and other habits is open to question. Among the habits attacked are drug addiction, excessive drinking, thumb-sucking, nail-biting, uncontrollable blushing, tics and bed-wetting.

**Psychiatry:** In Wisconsin, a 37-year-old man lay on his side, rolled in a ball with knees pressed against his chest and arms tightly gripping his legs. When no physical reason could be found for his unnatural position, doctors attributed it to a severe emotional shock at age 15. He adopted a prenatal posture as an unconscious desire to return to the security of the womb. Through hypnosis, it was possible to achieve some movement of arms and legs although surgery was necessary to sever some of the fibrotic tissue.

Hypnosis has been used by many psychiatrists as a short-cut in ther-

# A compulsive eater found her life was intolerable following hypnosis.

apy but there is a constant warning to the non-psychiatrically-trained doctor to be wary lest in removing a neurotic symptom he precipitate something more drastic.

Dr. Harold Rosen of Johns Hopkins cites the case of a psychotic obese person who committed suicide after her compulsive eating habit was hypnotized away.

A similar circumstance was reported by Dr. J. J. Hirning of Chicago. A patient had developed functional blindness as an escape from an intolerable life situation. When her symptoms were removed by hypnosis, she committed suicide.

"Great harm can be done when an untrained operator attempts to cure individuals with serious personality problems," Dr. Harning said.

In a recent evaluation of the dangers of hypnosis, Dr. Louis J. West, University of Oklahoma psychiatrist, said it can make an existing mental disorder worse or it may revive symptoms of an illness that was improving.

He also warned that a patient might become excessively dependent on the hypnotist but conceded that this danger is disputed.

One normal subject underwent such a pathological dependency reaction that she often went into a trance upon hearing the operator, a psychology graduate student, speak even in an ordinary social situation, Dr. West said. "Hypnotized repeatedly as a subject in demonstrations, eventually she could not make the most trivial decisions without consulting the hypnotist, and when he moved to a city 1,500 miles away, she followed him, leaving family, friends and her job."

Dr. West's conclusion: Hypnosis is a valid tool but there are dangers in its misuse to the patient, to medicine and to hypnosis itself.

### *One in a million*

An Australian woman with an extremely rare blood group made medical history by giving birth to her second healthy child in Brisbane. The blood group is VEL negative with antibodies and is so rare that only 20 other people in the world are known to have it. Doctors estimate that the chance of a person's having VEL negative blood with antibodies is one in a million.

According to medical references, only five women in the world with this grouping have had children. Until the Brisbane birth, only one of these, a woman in America, had given birth to two children. A person with the grouping does not suffer any ill effects, but doctors have always feared that their children could develop an RH-like disease. To date, there simply has not been enough evidence to determine the case one way or the other.

# This is zero force

Metal workpiece is drilled easily without pressure by electrochemical machining. It is one of the new methods being used to shape superhard space age materials.

by C. J. Vlahos

A NEW metal cutting approach, aptly called "zero-force" machining, may well be heralding the end of the lathe and drill press. As the name implies, it is machining without pressures—no pushing or paring of metal. Instead, there is a steady, quiet erosion of the workpiece, until the proper cut is made.

Why the zero-force? To fill an urgent need.

At one time, with carbide tools, industry could pare most metals as neatly as an orange. But in the space age, with new, tough superalloys and refractories, the carbides flopped. The new metals made mincemeat of carbides and traditional machining methods reeled back to their position 50 years ago.

Engineers decided the problem boiled down to finding a way of cutting that would be independent of the material's basic properties. "Zero-force," or "tool-less" machining—machining without cutting tools—was the answer. Now metal removal has become a function of

applied power, not of the material.

Electrochemical machining (also called ECM) is one such approach. Based on the Faraday principle of plating, it uses electricity as high as 10,000 amperes and less than 15 volts to whittle away at the workpiece material.

Here's how it works: In traditional plating processes a cathode and an anode are immersed in an electrolyte and a direct current is passed between them. Positively charged particles leave the anode, pass through the electrolyte, and are deposited on the cathode. Erosion, a gradual dissolving, takes place at the anode until it is formed exactly as the cathode, clean and smooth.

Engineers seized on this phenomenon and made it the basis for ECM. Why not shape a cathode to the desired configuration of the workpiece? Keep pumping an electrolyte of salt water through a filtering system, advance the cathode (tool) to the anode (workpiece). Then any shaped anode can be made to dissolve to the exact shape of the cathode profile.

Essentially, then, electrochemical machining is a deplating process, shaping metal with no arcs or sparks, no straining pressures, and without heat or damage to the workpiece. What's more, the tool, generally made of ordinary brass or copper, has an almost indefinite life, making the process the ultimate in a tool engineer's dream.

Where is it being used? Its greatest usefulness lies in the drilling of all kinds and sizes of burr-free holes and in the machining of difficult shapes, in super-tough metals, like tungsten, or even in ordinary metals.

## Effective drilling

One simple case, reported by General Electric, illustrates the effectiveness of drilling with ECM. The problem involved an 8 inch piece of relatively unmachinable thoriated tungsten that had to be made into tubing. Hole size was specified to be 0.140 inch diameter, plus or minus 0.005 inch. Using the ECM process, the electrode was advanced into the work while the electrolyte was kept moving. In time, the hole was formed. While the feed rate was a modest 1.2 inch per hour, ECM was justified because at the time it was the only source of tungsten tubing available in the country.

By varying the advance rate of the electrode and amperage, shapes of holes can be varied, even to tapered designs. Size is no problem, either. The Hanson-Van Winkel-Munning Co., Matawan, N. J., tells of how they easily produce holes as small as 0.020 inch diameter, up to 150 diameters long. In fact, in their labs, they have gone down to a gnat's hair—0.005 inch. A drawn glass pipette, with a platinum wire running through it, is used as the tool, the electrolyte being forced through the pipette.

Another practical tool-less machining method is electrical dis-

charge machining, called EDM.

As with electrochemical machining, EDM also works by eroding, or vaporizing, the metal workpiece. Only this time, the job is done by spark discharges from an electrode. Here's how it works:

In the EDM machine, sparks are repeated many times each second, and the electrode is preshaped to the configuration of the desired cavity. Rate of advance into the workpiece is controlled by a servomechanism, making possible an automatic arrangement.

### Electronic avalanche

In a typical EDM application both workpiece and electrode are immersed in a dielectric solution. When the electrode is advanced into the workpiece, the solution ionizes and an electronic avalanche tumbles from electrode to the workpiece, this being the spark. As the spark strikes the workpiece, it heats the area of contact to the temperature of vaporization. A typical EDM machine repeats this from 10,000 to 100,000 times per second.

Important to the process, of course, is the cleanliness of the dielectric solution, which is usually a hydrocarbon oil, sometimes carbon tetrachloride. Just as in ECM, the dielectric must be kept moving. This way, chips are carried away from the spark gap, keeping the ionization process in balance. Besides being the spark carrier, the dielectric keeps the workpiece at an even temperature.

Metal removal rates are from 15 to 20 cubic inches per hour. While this may be considered extremely slow, EDM is impressive when metals of increased hardness can't be machined any other way.

### EDM and V-8 engines

One typical application is the manufacture of Ford's new 4-cam Indianapolis engine. Ford revealed that electrical discharge machining played a major role in their bid for "500" laurels.

Engineers machined the critical aluminum cylinder heads for a special 255 cubic inch V-8 engine with EDM equipment made by Elox Corp. of Michigan, Troy, Mich. A. E. DiGregorio, Ford's manager of manufacturing improvement, stated that EDM was a natural for the Indy engine combustion chambers. Reason: quality of machining by EDM is so consistent.

Right now, EDM's main application is in producing industry's tough dies—forging, blanking, piercing, trimming, cold heading, injection molding, and extrusion dies. It is also used for resinking worn or washed out dies. Other applications are in the machining of fragile and complicated assemblies of honeycomb, machining burr-free holes, and making many odd and complicated shapes in hard-to-machine metals.

At present, ECM and EDM are the only zero-force processes that have some application in industry. But their future seems unlimited.

**Chicago surgeon Dr. John F. Mullan has developed a revolutionary new operation procedure which provides a . . .**

# New way to relieve pain within minutes

**by Dr. Lorraine Getz**

SINCE the beginning, man has been confronted by the problem of physical pain. The constant pain that accompanies some injuries such as severe burns, and illnesses such as diabetic neuropathy (a nerve disease), presents a difficult medical problem. Even in pre-scientific medicine, healers were concerned with stopping pain as well as curing disease. In 20th-century medicine, it still is desirable—if not mandatory—to alleviate the patient's sufferings as much as possible for both humane and therapeutic reasons. In the pain-killing process, however, the patient should not be permanently incapacitated.

While frequently offering temporary relief, drugs may have undesirable side effects.

Dr. John F. Mullan, professor of surgery in the Department of Neurosurgery at The University of Chicago, has developed a new procedure for the alleviation of pain.

It involves a delicate, two-hour operation on the spinal cord (a cordotomy) and it has been used with more than a hundred patients.

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Relief from pain is complete, comes within minutes, and lasts up to six months. Only the nerves carrying pain impulses are affected.

The affable Mullan discussed the technique while seated at his desk that was piled high with papers and journals in his small office on the third floor of Albert Merritt Billings Hospital. "I'm a bit behind in my paper work," he explained.

He told of a patient admitted to the University's Medical Center for treatment of severe radiation burns on his arm, suffered in an industrial accident. Drugs failed to relieve the constant, almost unbearable, pain. But a neurosurgery team performed a "direct current electric cordotomy" which immediately freed the patient of pain during the long weeks of his recovery.

Electric cordotomy requires only local anesthesia and it is more precise than previous methods. Moreover, there is a good chance that in six months or less the patient will regain his normal sensitivity to pain in the electrically anesthetized area.

"Percutaneous electric cordotomy allows us to produce pain loss for persons who have severe pain for only limited duration," Dr. Mullan says. "Previous to this, we have not thought it desirable to interrupt pain nerves except in instances where it was known that the pain would persist until the end of the patient's life.

"In such instances, the relief of pain is of course worth the inconvenience of not having pain sensation. But this inconvenience in cases of lesser severity must not be ignored, for pain itself is an important warning sensation of many illnesses and injuries to which we may be subjected in later life."

Surgical cordotomy was first successfully performed in 1912, and remained the standard way to relieve intractable pain until the 1960's. It is a major operation requiring a general anesthetic, and its effects are designed to be permanent. Often those who needed pain alleviation most—persons afflicted with terminal malignancies —were too weak and debilitated to withstand this procedure. The mercy of complete pain cessation could not be administered.

The spinal cord is difficult for a surgeon to get at because this delicate, vital cable of nerve fibres is encased in protective bony armor. The cord runs down from the base of the brain through the overlapping vertebrae which form the backbone. Surgical cordotomy entailed the removal of parts of vertebrae before a carefully placed knife incision could be made in the cord to sever pain fibres.

In 1962, Dr. Mullan and his colleagues devised a way to get into the spinal cord without cutting vertebrae, and to create a lesion in the pain fibres without making a knife incision. They used a chink in the spinal cord's armor through which they could insert a thin needle impregnated with radioactive strontium.

"At the very top of the spine,"

# Pain ceases for a brief number of months after electric cordotomy.

Dr. Mullan explains, "the first cervical vertebra (in the neck) rotates on the second vertebra. There is a space between them to allow these bones to override when the head and neck are turned. This space is ample for the insertion of a needle."

The spinal cord in the region of the neck is only a bit more than a half-inch thick, and the total area of a cross-section is consequently quite small. But this constricted cable carries all the nerve fibres conveying strength to the arms, legs and trunk. "It is obvious that extraordinarily serious if not fatal damage could occur if too big a lesion should be made," Dr. Mullan says.

## New technique

Dr. Mullan's new technique was to insert the strontium needle until it rested inside the dura and against the spinal cord. The needle was carefully guided by the use of X-rays. Effective radiation to a depth of one-tenth of an inch—the same depth as the surgical incision—was achieved in about 30 minutes. The needle was devised by Dr. Paul V. Harper Jr., professor of surgery and associate director of the Argonne Cancer Research Hospital, operated by The University of Chicago for the U.S. Atomic Energy Commission. It was given extensive physical and biological trials before it was first used on a patient suffering from intractable pain in mid-1962.

The procedure proved to be not too difficult for the patient, and usually he was able to leave the hospital within 48 hours.

"Pain relief by this strontium technique begins within the next few days," Dr. Mullan says, "and by the end of a week the loss of pin-prick sensation develops peripherally. Pain loss in the leg area is usually complete within a week, but one to three months may elapse before pain loss becomes complete in the arm area.

## Numerous problems

"This procedure is very suitable for pain in the lower half of the body. But because of the delay it is not very suitable for pain in the upper half of the body. A higher initial dose of radiation could produce pain relief in the arm within a few days, but would entail the risk that three months or more later the nerves which control movement would be impaired.

"For this reason," Dr. Mullan continues, "we set about devising a technique which would provide early sensory loss in the upper trunk and arms. After the experience of more than 100 needle insertions to the surface of the spinal cord without difficulty, we began to

realize that it would be possible to insert a needle into the cord with safety."

Dr. Mullan's research team made a long series of biological tests with a needle about one-hundredth of an inch in diameter, through which a mild direct current electric impulse was passed. The team used X-ray control to guide the needle to the proper area of the spinal cord. The cord was then stimulated by a gentle electric current. The patient experienced a tingling, or a sense of warmth or cold, in the body area served by pain fibres in the immediate vicinity of the needle. When the needle was put in the proper position to achieve the desired localized anesthetic effect in the upper body or arms, the current was stepped up. A tiny lesion developed. Pain loss was achieved in 30 minutes.

Dr. Mullan's neurosurgery team has performed more than 100 of these direct current electric cordotomies with good results. The return of pain sensation in about six months in some patients was an unexpected advantage. This has not been observed in patients who received strontium cordotomies.

"Now it seems possible to perform an electric cordotomy," Dr. Mullan says, "to give temporary relief for patients with severe but limited pain, such as that which occurs in herpes (shingles), and diabetic neuropathy (a nerve disease), and even in instances of severe trauma such as burns.

"In both the strontium and electrical cordotomies, it is the pain fibres of the spinal cord which are specifically knocked out, and motor power and other types of sensation are not impaired at all.

Dr. Mullan and his associates also have used alternating electric current at radio frequencies as first suggested by Dr. Hubert Rosomoff of the University of Pittsburgh. This produces a lesion in only 30 seconds. Control of the lesion produced is less precise, but early experience indicates the lesion will last longer. The shorter operation is an advantage for the patient, and Dr. Mullan believes better control of the radio frequency current lesion gradually will be achieved with experience.

Dr. Mullan cautions, that this type of operation is still new. "Much work remains to be done toward the development of a more simple and more perfect technique. Already we are considering the use of laser beams in the laboratory."

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"...9..8..7..6..5..."

# PLEASE EXPLAIN

## The mystery of Easter Island

KFS

The Easter Island statues are familiar to everyone, but many find their origin obscure.

### Who built the mysterious Easter Island statues?

The giant statues on Easter Island (called Rapa Nui by the Tahitians) were built by the ancestors of the Polynesians who now live there. But since many find mysteries more exciting than facts, this simple explanation is not always accepted.

Easter Island is a good place for a mystery. It is a volcanic island, 45 square miles in area, in the middle of the Pacific. It is one of the most remote places in the world. The nearest island is uninhabited Sala-y-Gomes, 210 miles away. The coast of South America is 2,000 miles beyond that. In the other direction, you must go 1,200 miles to reach desolate Pitcairn Island, where the mutineers of *H.M.S. Bounty* went to find an out-of the-way place to hide.

There is some controversy about the origins of the Easter Islanders, but most scientists are convinced that they originally came from the coast of Southeast Asia. The Polynesians were great seafarers. They settled the Pacific islands, probably reaching Easter Island in about the Ninth Century A.D. The first white man known to have landed on the island was the Dutch admiral Jaakob Roggeveen. Since Roggeveen landed on Easter Sunday, 1772, he named the place Easter Island.

There are still over 600 statues on the island, despite the fact that many were broken up for building material and others shipped off to distant museums. Many statues are over 30 feet high, and some unfinished ones are over 60 feet. Today, Easter Island is sparsely populated, and many wonder how such a small number of primitive people could have created such a mass of colossal carvings.

But the population of Easter Island was not always small. When Roggeveen landed, the island had thousands of inhabitants, and a

complex and a thriving culture. In the intervening years, internal warfare, slave raids and the white man's diseases nearly destroyed the native population. By 1877, only 111 Polynesians were left. Since then, they have been making a moderate comeback, and the population is now over 800.

The statues probably had a religious significance and were set up around platforms on which the dead were exposed before burial. The custom is not unique among Polynesians. Inhabitants of other islands did much the same thing, but their statues were usually made of wood and decayed quickly. Wood is scarce on Easter Island, but volcanic rock is plentiful. It is easy to work it with simple stone tools, yet it endures. It's difficult to tell how old the statues are, but most scientists assume that all of them were carved before the 18th century.

Although modern Easter Islanders no longer carve statues, they have not lost all knowledge of them. Scientist-adventurer Thor Heyerdahl got some of the natives to raise one of the fallen giants. It took six men 18 days to accomplish the feat. They pried up one end and put stones under it, then they lifted it a bit more and added more stones, and so on. When the statue was raised to a great enough angle, they finished the job by pulling it completely upright with ropes. The method was crude and time-consuming, but effective. In their days of glory, the Easter Islanders had

plenty of time and manpower to complete the job.

The statues are usually thought of as heads or busts, but for the most part they are full length. The bodies are so small in comparison to the huge heads that they are often overlooked. When standing upright, the statues are usually buried up to the neck in debris.

It may be disappointing to explain all the mysteries about Easter Island, and so a final unsolved mystery might be mentioned. This concerns the rongorongo boards, wooden boards with lines of pictograms carved in them. It seems the Easter Islanders were the only Polynesian people to develop a system of writing. But what do the boards say? All the natives who could read them were killed off and most of the boards themselves were destroyed under the influence of missionaries who saw them as relics of paganism. Only about 20 survive today. Even here the mystery may not remain a mystery much longer, for scientists are making headway in making the forgotten language of Easter Island understandable again.—*D.C.*

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**This new regular feature of *Science Digest* will attempt to answer questions about the how's and why's of science. Send your question to Please Explain, Science Digest, 1775 Broadway, New York, New York, 10019.**

**Ads for fabrics and clothing made of artificial fibers have me confused. What are the principal kinds of man-made fibers?**

There are two main groups, cellulosic and noncellulosic. Cellulosic fibers use cellulose, which is found in plant life. Noncellulosics are produced from chemicals.

Rayon and acetate are the principal kinds of cellulosic fibers. Noncellulosic fibers come in a wide variety of forms.

The rayons include viscosé rayon, which can be made to resemble cotton or wool. Another rayon, cuprammonium, is fine and shiny and is used for sheer fabrics. Acetate is a mixture of cellulose and chemicals and is used for pliable fabrics such as are needed for curtains.

The best-known noncellulosic is nylon. This belongs to the polyamide group, which is made from chemicals obtained from coal, oil, water and gas and from various plants. Dacron, Fortrel, Vycron and Kodel are polyester fibers, which are resilient and nonabsorbent. Creslan, Acrilan, Zefran and Orlon are acrylic fibers, whose main characteristic is fluffiness. Polyester fibers are made from chemicals obtained from coal, air, water and petroleum. Acrylic fibers are made from chemicals obtained from coal, air, water, petroleum and limestone. Salt water and petroleum make polyvinyl fibers such as polypropylene, used for auto seat covers and blended with wool for clothing.

There are also protein fibers

(made from corn, soybeans and peanuts), which are blended with other fibers to provide absorbency and softness, and glass fibers, which have high tensile strength.—*H.P.*

**Are any creatures, other than birds or mammals, able to regulate their body temperature?**

Only birds and mammals can maintain a constant body temperature, thereby being able to adapt themselves to various climates.

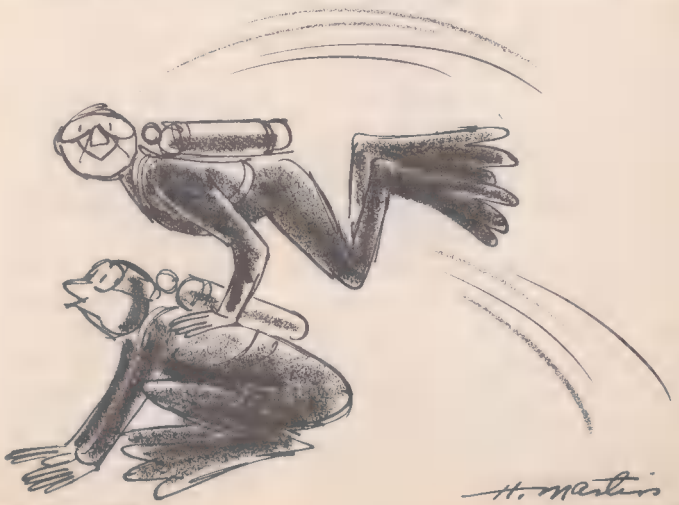
Temperature measurements of the female Indian rock python, however, proved the female maintains a temperature high enough to insure that her eggs hatch. Measurements were taken about three years ago by Dr. Herndon G. Dowling, curator of reptiles at the Bronx Zoo.

As far as is known, this is the only reptile able to generate heat to control its body temperature. Spasmodic contractions of its muscles produce the heat. Birds and mammals produce heat by shivering and by increasing their metabolism.

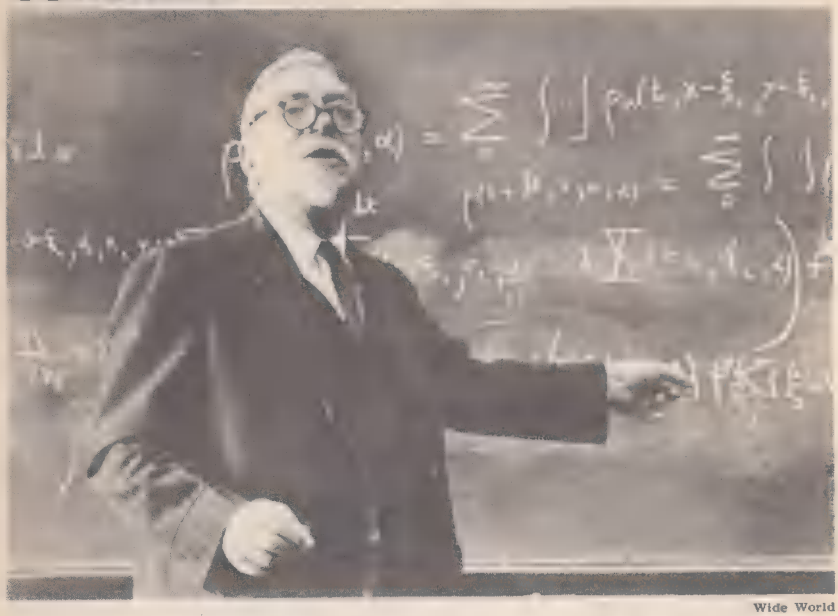
The rock python, which weighs from 60 to 150 pounds, is the only giant snake that ranges into cool areas of the world. It is found, among other places, in the foothills of the Himalayas.

The female lays about two dozen eggs once a year and coils herself about them. During incubation, she does not eat.

The verification of internally-produced heat is significant in evolutionary studies. One of the distinguishing characteristics of reptiles is lack of a mechanism to produce heat internally. The limited temperature-control capacity of the female rock python could indicate such primitive reptiles as dinosaurs may have had rudimentary temperature controls.—*J.R.*



# COMMENT



Wide World

Dr. Norbert Weiner began studies of parallels between man's brain and computers. Already the young science has had a tremendous, and not entirely benign, effect on society.

## Can we improve on nature too much?

by Alan Smith

Most animals evolve as the result of a series of internal changes. Man is the one notable exception to this biological rule.

In the eyes of some anthropologists, man's evolution is, to a large degree, the product of external factors of his own invention. To give you one simple example, we no longer need as much body hair as our ancestors, because clothes and central heating do a much more efficient job than a good fur coat.

The question now is: Where is this all leading?

Consider for a moment the magnificent job nature has done in constructing the eye. Any scientist would throw his hands up in horror over the impossibility of constructing a good working lens out of little more than water and jelly, as nature has done. But there is no law, natural or otherwise, that says nature cannot be duplicated through the use of other materials;

and without drawing the idea out any further, it's sufficient to say that any good camera lens is optically superior to the eye.

On a more complex plane, now, imagine a miniature computer, smaller than a silver dollar, which can, by detecting infra-red radiation, accurately track a moving object in total darkness, compensate for speed and evasive maneuvers and, with considerable accuracy, launch an interceptor. Nature produced just such a computer in the brain of a rattlesnake. We use similar ones, a bit larger perhaps, but far more accurate and deadly, in our heat-seeking anti-aircraft missiles.

These are just two examples of man's present-day ability to produce highly sophisticated tools which duplicate and, in some respects at least, are improvements over nature's own efforts. There are countless more if you want to take the time to look for them. Our tool-making ability probably began when some pre-human ancestor discovered that a rock could extend his food-gathering abilities. Then, other tools were developed so that the rocks could be shaped for more effectiveness, and so on.

There is, however, a freshman college axiom stating that anything carried to its logical extreme becomes ridiculous. In terms of human interactions, we must substitute "catastrophic" for "ridiculous."

Not too long ago, under the aegis of the late Dr. Norbert Weiner, a new science called cybernetics was born. It is, essentially, the study of parallels between machine and organic processes. And even today, while still in a more or less fledgling stage, cybernetics has produced considerable economic upheaval through the introduction of industrial automation.

## Living systems studied

But let us go further and look at what's happening in the area of bionics, a closely related and natural outgrowth of cybernetics. Bionics, an Air Force term, describes "the science of systems which function, after the manner of, or in a manner characteristic of or resembling, living systems."

Actually, what's happened here is that cybernetics has been incorporated into a research area of much greater scope that concerns itself not only with brain or brainlike functions but also with all of the sensory, adaptive and reproductive abilities of a living organism. And if these goals seem a little hard to accept, it's only because too many of us still think in terms of Capek's Robot or Shelley's Frankenstein.

In 1954, someone wrote of the practical impossibility of building a mechanical brain as complex as the human one. He pointed out that the

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During Hugh Downs's vacation, his column will not appear. Instead, *Science Digest* will publish columns by others. This month's is by a writer who specializes in scientific subjects for the "Today" show, which Hugh Downs hosts.

# A machine might grow replacement parts to alter its own circuitry.

space required for as many tubes as the brain has nerve cells (some ten billion) would require a building larger than the Empire State Building, the hydroelectric output of Niagara Falls to power it and the Niagara River to cool it.

In all fairness to the author, I must point out that he based his conclusion on the short-sighted assumption that vacuum tubes would never be replaced. They have been replaced, of course, and the magnetic-core memory units in common usage today are so tiny that a quarter of a million of them could be placed within a single vacuum tube of the type used in computer construction 11 years ago. And even these are rapidly being supplanted today by still smaller units. We still have a long way to go, of course, before we can cram ten billion units into a human brain-sized area, but it's no longer quite so far out of the realm of possibility.

As for the sensory, adaptive and reproductive functions of a living organism . . . well these, too, seem far less unattainable. A hand-like computer extension has already been built with a series of sensors in it so that a machine, if so instructed, could find a paper wad on the floor, pick it up and put it in the nearest waste basket. Extend this research a bit and the idea of an electronic brain roaming around doing odd jobs is no longer quite so scientifically inconceivable. It's also well within the bounds of future possibility to build a highly complex machine that is quite capable of building (reproducing) similar machines whenever the situation demands.

The adaptive function is a bit more difficult to envision but may well grow out of research into the area of metallic crystals such as the ones we're presently using in our transistors. Since the crystals are presently grown under laboratory conditions, there's no reason to assume that, given the proper chemicals, an electronic brain couldn't grow these crystals as the necessity arose and thus alter its own circuitry in very much the same manner as the brain adds new neural pathways in its natural process of adapting.

What about the actual thought process, the ability to reason and to produce creative expression?

We like to think of this as something that only man can do, and our ego generally refuses to believe otherwise. There was a time, though, when we also refused to believe that the body did not have some mysterious power to produce otherwise impossible chemical compounds. And though it came as somewhat of a blow to us, we've since learned that, given the proper conditions, chemicals react exactly

the same in a test tube as they do inside our body. And if you take a long, hard, unemotional look at the reasoning and creative thought processes, you'll find that there's nothing particularly mysterious about them either.

Reduced to its simplest form, reasoning is nothing more than the ability to use memories (stored information) and, when faced with a situation, to draw upon these in order to examine all the possible alternatives in order to choose a course most likely to produce some desired result. The creative process is nothing more than an extension of this same ability. Now a great many creative people would probably disagree with me violently here, but ten years ago I couldn't have conceived of a computer able to write a script. Since that time, one such script has been written and produced on an experimental basis. It was a pretty hackneyed plot, I'll grant, but even a man-made brain has to serve its apprenticeship.

I'll be perfectly honest in saying that I can't provide a single, all-encompassing answer to the question: When does logical progression in this area become catastrophic?

For many coal miners, that point has already been reached. My time will probably come if and when that script-writing machine graduates from its apprenticeship. And assuming our technology continues along its same, present path, each of us will eventually find our own, personal version of catastrophe brought about by technological innovation.

There's little doubt in my mind that if things progress to their logical extreme, then we'll undoubtedly produce machines which can do anything better than we can and, when that day comes, what do they need us for?

### Machine descendants?

It's not unlikely that the first known tool-maker, our prehuman ancester, *Paranthropus,* became extinct because he couldn't compete with the tool-enhanced abilities of the next species up the evolutionary ladder. Nowadays, it's getting pretty difficult for *Homo Sapiens* to compete with some of his own tools, and more than one observer has said that we may be on the verge of designing our own "descendants."

Of course, there's nothing new about the idea of man's being supplanted by machines. The concept is so trite that most science-fiction writers won't even touch it.

I, for one, find myself growing increasingly less amused by the cartoon of some years back. It shows two technicians looking at a computer read-out and one saying to the other, "I think it wants a human sacrifice."

If creativity could be programmed, we might compete with our machines.

USDA Photo

Rauwolfia, one of the best sources of a drug useful in the treatment of high blood pressure and mental illness, is checked at a Department of Agriculture greenhouse.

# Plants that cure—quiz

by John and Molly Daugherty

WE'RE learning more about the healing and pain-killing properties of plants all the time. How much do you know?

1. Antifertility drugs which control ovulation are derived from the steroids of
   a. Seaweed from the Sargasso Sea
   b. The roots of Mexican wild yams
   c. The dried roots of the mandrake
2. What percent of new drug prescriptions have drugs of natural origin as the only active ingredient or as one of the main ingredients?
   a. 87 percent
   b. 10 percent
   c. 47 percent
3. The poisonous nightshade plant belladonna contains
   a. Atropin
   b. Absinth
   c. Morphine
4. LSD, a drug useful in studying mental disease, comes from
   a. Ginseng
   b. Garlic
   c. Ergot fungus
5. Which one of these plants finds use in the treatment of colds, asthma and hay fever?
   a. Senna
   b. Aloe
   c. Ephedrine
6. Which plant is a source of digitalis?
   a. Henbane
   b. Foxglove
   c. Buttercup
7. From which plant is an usnic acid, broad-spectrum antibiotic prepared?
   a. Reindeer lichen
   b. Sphagnum peat moss
   c. Pennyroyal

8. From which is quinine obtained?
   a. Curare
   b. Cinchona
   c. Cascara
9. Which one of these yields a drug that comes from the seeds of its fruit and led to a treatment for leprosy?
   a. Chamomile
   b. Hops
   c. Chaulmoogra tree
10. Which is the source of strychnine?
   a. Wormseed
   b. Nux vomica
   c. Psyllium

## Answers:

**1—b** The dried roots of the Mexican wild yam *Dioscorea* are washed, chopped up and put into tanks to ferment. Bacteria in the air releases the diogenin processed into hormonal substances.

Seaweeds are quite antibiotic. Red and brown seaweed produce anticoagulants that compare favorably with heparin (from animal tissue).

An extract of the American mandrake or May apple is used for certain warts and skin growths. An anticancer agent SPI-SPG from mandrake-like plants is being tested in Switzerland.

**2—c** According to a prescription audit, 47 percent in one year. The market for medicinal plants is $300 million and upward.

**3—a** Atropin. Atropin is used to stimulate the heart, to dilate the pupil of the eye and to relieve spasms. The plant belladonna (Italian for beautiful lady) was named during the days of the Borgias when poison was popular. But ladies of the court used it to make their eyes seem beautiful.

Absinth from the green oil of the absinth plant can cause paralysis. Its use is banned in some countries.

Morphine comes from the opium poppy *Papaver somniferum*. Its use is valuable in medicine to relieve pain.

**4—c** Ergot is a blight on rye, wheat and grasses. It replaces grain with a fungus growth *sclerotium*. LSD is a derivitive of lysergic acid, the nucleus of all ergot alkaloids. They are in seeds of the morning glory *Spomoea tricolor* and the "magic" mushrooms.

Garlic has been used for centuries as a potent remedy for various diseases. The Roman Legions ate it to get courage to fight.

The herb ginseng is believed to be a cure-all in China, Japan and the Far West. We export it as we find little use for it here.

**5—c** Ephedrine. The plant is a small leafless shrub with slender green stems. It has been used in China for thousands of years. It has recently been used in the United States as a treatment for colds, asthma and hay fever.

Aloe leaves from Africa and the West Indies contain a resinous juice which contains several glucosides. The juice is evaporated into a thick viscous material which solidifies and is used as a purgative.

Senna comes from species of *Cassia*. It is found in the arid regions of Arabia and Egypt. It's used as a purgative.

**6—b** Foxglove. Digitalis from the dried leaves of foxglove is important in cardio-vascular therapy. It is also used to treat glaucoma and to slow the progress of muscular dystrophy.

Foxglove grows freely in the United States. Its most active principle is the gluoside digitoxin.

Henbane grows as a weed in Europe and Asia. It is used as a sedative and hypnotic. Scopolamine and hyoscyamine come from henbane.

Buttercup juice has bacterial qualities that arrest growth of staph, strep, anthrax, pneumonocci, and tuberculosis germs.

**7—a** Reindeer lichen. It has been used for food during famine in Scandinavia. The antibiotic is prepared in Finland and shipped to neighboring countries, the Far East and Africa to treat serious skin infections and tuberculosis.

Sphagnum peat moss was used in World Wars I and II in bandages. It contains disinfecting substances besides possessing absorbant qualities.

Pennyroyal is a small aromatic plant used as a counter-irritant in liniments, although its greater use is as an insect repellant.

**8—b** From the bark of the Cinchona tree. Quinine has been invaluable in the treatment of malaria, the greatest cause of physical disability and the world's costliest disease, according to the World Health Organization. Synthetics have now been developed for quinine. Chloroquine and primaquine, synthetics, were used in the Korean War. Infecting protozoans develop new strains that resist synthetics, however, but resistance to quinine from cinchona is rare.

Curare was used by Indians for poisoned arrows. Its alkaloid, curarine, is a medicine used in shock therapy as a muscle relaxant. It is a sedative and is used in chronic spastic conditions.

Cascara from the bark of the western buckthorn is a tonic and a laxative. It was used by the Indians and the early Spanish settlers here.

**9—c** Chualmoogra tree. Natives of Southeastern Asia used the seeds and oil to treat skin diseases. Research at the University of Hawaii used acids in the oil and ethyl esters of the acids to produce an effective treatment for leprosy.

Hops are used in the brewing of beer, but they have also been used in medicine for sedative and tonic properties.

The dried flower heads of chamomile, a plant like a daisy, have an oil used as a tonic and gastric stimulant.

**10—b** Nux vomica. The drug nux vomica comes from the seeds of the flowers of the *Strychnos nux-vomica* tree, native to India, Australia, Cochin China, and Ceylon.

Strychine is an important alkaloid extracted from the seeds. Small doses are used to treat nervous disorders and paralysis. Large doses are poisonous.

Wormseed occurs native in Central and South America and the West Indies. It is cultivated in Maryland. The oil from its fruits treats hookworm infections.

Psyllium seed comes from fleaworts, a species of plantain in Asia and Europe. It's a mild laxative.

## Score Yourself:

**8—10 right**—Very good.
**4— 7 right**—Not bad.
**0— 3 right**—Oh well!


**Probability quiz**

Concerning question 3 in the quiz at the end of the article, "How Chance Affects Your Life" (Aug. '65), it seems probable that mathematicians for centuries have realized that numbers in use more often start with 1, 2, 3 than with 7, 8, 9. It is inherent in our number count, where you have to go through with 1, 2, 3 to get at 7, 8, 9; and in fact the only way 7, 8, 9 can be even with 1, 2, 3 in the count is to go all the way to 9—or to 99—or to 999—and stop there.

Take days of the year for example: Each morning our radio announces the day of the year. The first three days' count is 3 for 1, 2, 3, not to be caught up with until the 9th day (7, 8, 9). The 1, 2, 3 lead picks up again at 10, 11, 12, etc., not to be nullified until 99 is reached and picks up immediately thereafter at 100, and for all the rest of the 265 days of the year—a final score of 299 to 33 in favor of 1, 2, 3; and, in this case 4, 5, 6, rate only 33 also.

While we no longer, as did Stone Age grandpa, count: "One, two, many," we do tend to devices that keep numbers down; it still seems to make them more comprehensible. Milady will even descent to fractions and order 2½ yards of dress material rather than 90 inches; in acreage, we do not get up to 700 before we drift off into square miles.

There is one area, though, where 7, 8, 9 predominates. That is in this section of the country where our summer temperatures are expressed, 24 hours a day, in 70's, 80's, 90's!

HERBERT H. MUIR
Tryon, N.C.

**Solid intellectual fare**

Flora Rheta Schreiber's and Melvin Herman's article about LSD ("Inside Psychiatry Today," Aug. '65) illuminates every aspect of this important subject. So much nonsense appears about it that it is refreshing to find the Schreiber-Herman sense. But then I have found their column to be solid intellectual fare and emotionally rewarding all through. I've read every word they've written in your fine pages.

Thank you to both you and them.

ELIAS ARONSON
New York, N.Y.

**Kudos**

As a believer in 'pure' and unadulterated science, free of hokus-pokus and diverting manipulations by pretenders and intentional frauds, I've come to rely upon *Science Digest* for clear and concise and simple evaluations of all the new and old developments in our human society.

Thanks for keeping me informed. Often I find your articles help me understand the varied social elements I am often in contact with.

GEORGE BLACKMER
San Francisco, Calif.

As a regular reader of your magazine for many years, I take this opportunity to extend my appreciation and thanks to a very worthy publication. Covering various aspects of the sciences, your topics and presentation makes *Science Digest* a magazine for the scholar, the student and the layman.

Naturally some articles demand technicalities, but over all, your magazine is unique in translating into "plain English" information that Mr. Average could not otherwise appreciate.

Being a radio and television broadcaster and having a serious interest in "the nature of things," I feel qualified to commend you for such a fine publication.

R. G. CUMPSTY-CUMMINGS
Port Arthur, Ontario
Canada

So many interesting things in the July issue of *Science Digest*, that I will have to watch for it regularly.

JAMES F. WELTON
Cleveland, Ohio

**Unhealthy view**

In "Tips and Trends" (April '65) is the statement that we are getting healthier. I disagree with this statement and so do many others. It is not supported by statistics, except for the marked improvement in infant mortality, maternal mortality, and infectious diseases. It is very much not true of the chronic disease picture.

In the "Vital Statistics of the United States 1958, Vol. 1," I note that the average number of years of life remaining for a newborn infant (white male) has increased 19.0 years since 1900. But for the white male of 50, the life expectancy has only increased 2.1 years since 1900. This seems like a very small gain.

FRANCIS SILVER
Martinsburg, W. Va.

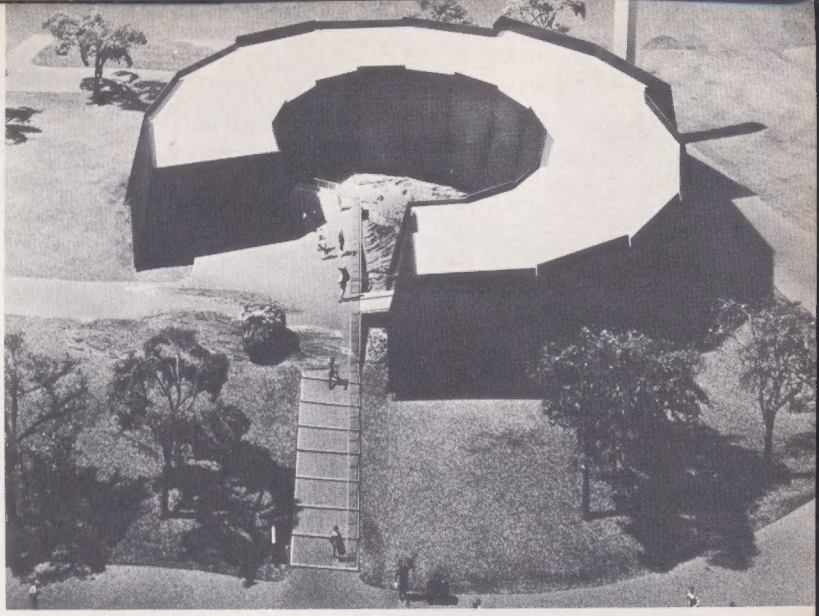
**43 years ahead**

I was quite surprised to find my "man in space" on the cover of your August 1965 issue. This dates back to the February 1922 issue (below)

of *Science and Invention*. The idea, of course, is the same and I am surprised that Dr. Asimov made use of this ancient idea at all.

HUGO GERNSBACK
Gernsback Publications, Inc.
New York, N.Y.

*Bell Aerosystem's rocket belt, now being demonstrated around the world, inspired our cover. We salute publisher Gernsback on foreseeing this 43 years ago.—Ed.*



# Turning day into night

FOR HALF the wild creatures dawn is curfew. These night animals, such as bats, salamanders and owls are active only after the sun has gone down.

Nocturnal animals are a great disappointment to zoo visitors, for when he comes to see them they are asleep. During the past several years, the Bronx Zoo in New York City has been experimenting with ways of reversing the animals' activity cycle so visitors can see them pursuing their daily activities, rather than dozing in a corner.

The zoo has now decided to dedicate a major building to nocturnal animals. The low rambling structure (above) will be shaped like a doughnut from which a bite has been taken. Within, visitors will circulate next to the interior wall, while the exhibits will be arranged on the outside wall.

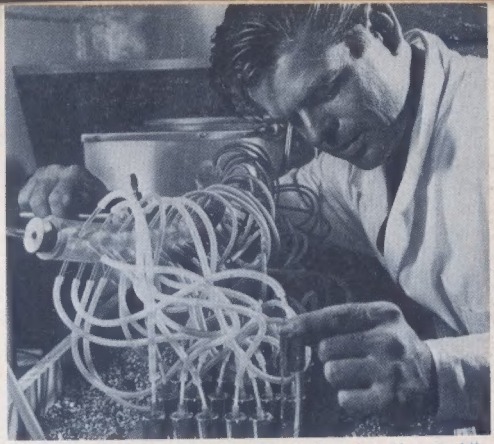
The structure will include complex time-clock-controlled illumination devices which automatically dim the exhibits during visiting hours and light them brightly during the night. In some of the exhibits, red light is used during the day for many nocturnal animals are red color blind. Naturally, this reversed light pattern "fools" the animal into thinking day is night.

Visitors to the World of Darkness will come into it through a "light lock" which, in addition to preventing daylight from entering, will give the people time to adapt their eyes to the relative darkness of the building.

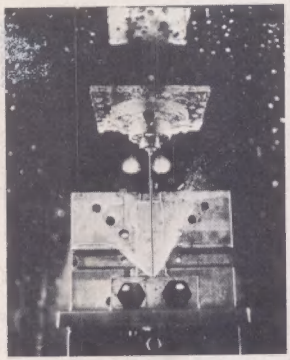
The exhibit is scheduled for completion by the fall of 1966.

# *In this issue . . .*

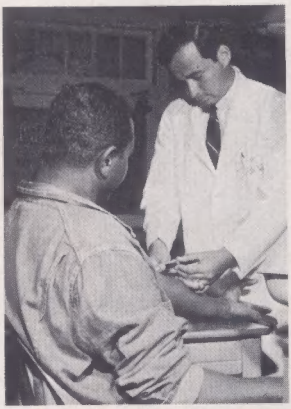
The Government spends billions annually for scientific research. The question of who gets how much, is a brutal one. Page 28.



Space scientists may ultimately help solve the world's fresh water shortage. The techniques they are developing for reusing water on long space voyages show promise of having even more important earthbound uses. Page 24.



Space age metals have made conventional machine tools obsolete. For a rundown on new metal working techniques see page 77.



A new vaccination technique may give medical science a weapon against man's most persistent enemy, the common cold. Page 56.

Harold Brown, new Air Force secretary, has a unique qualification for his job—a PhD in Physics. See page 17.

On remote Easter Island are hundreds of giant statues that have puzzled travellers for years. Who built them and why? Page 84.

A woman scientist looks at the position of the members of her sex in science today and finds it awful. Her denunciation of the situation begins on page 60.